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Evaluation of the Private Applicator Pesticide Training and Certification Program
A Five State Study

Abt Associates, Inc.
Cambridge, MA

Prepared for

Environmental Protection Agency
Washington, DC

1981

U.S. Department of Commerce
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Prepared by:
Abt Associates Inc.
55 Wheeler Street
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Washington, D.C. 20460

Evaluation of the Private Applicator Pesticide Training & Certification Program:

A Five State Study

1981

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EVALUATION OF THE PRIVATE APPLICATOR PESTICIDE TRAINING AND CERTIFICATION PROGRAM: A FIVE STATE STUDY

FINAL REPORT, 1981

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Project Director

Jonathan D. Hodgdon,
Deputy Project Director

Prepared by Abt Associates Inc. for the Environmental Protection Agency and the Council on Environmental Quality under Contract No. EQ9AC014, as amended. Opinions expressed herein are those of the Contractor and do not necessarily represent the official views of the sponsoring and participating federal and state agencies.

Studen Contract Manager	Quality Control Reviewer	Management Reviewer

PREFACE

The success of this research project was critically dependent on the state lead agency and county extension service personnel who contributed substantial amounts of their own time and energy. With the encouragement and enthusiasm of these people, we were assured that the research approach and analysis of findings would be sensitive to the private applicator pesticide training and certification programs in each of the five states. I would like to acknowledge the substantial contributions of the following state representatives who were advised, and provided advice, throughout the many months of planning, data collection, analysis, and presentation of results:

James E. Dewey, New York
Harold Stockdale, Iowa
Winand K. Hock, Pennsylvania
Burton R. Evans, Georgia
Emery W. Nelson, Nebraska

There were also a number of individuals at the federal level who were especially interested in the project and who participated at various stages throughout the contract. Most notably, the Project Monitors from the Program Support Division, EPA, Philip Robinson and Evan Vallianatos, and James V. Parochetti, SEA-Extension, USDA.

In any project of this size and duration, there are literally scores of individuals who play a part in making the enterprise a success. On the Abt Associates research team were several individuals whose contributions were especially noteworthy. Jonathan D. Hodgdon directed the analysis and, along with Ralph T. Jones and Mark Weissberg, authored substantial chapters of the report. Linda Steeves, the contract secretary, was crucial in insuring that all these pieces came together in this final report.

Laura R. Studen
Project Director

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1.0 INTRODUCTION

In 1972, the federal pesticide program was significantly revised through the enactment of amendments to the Federal Insecticide, Fungicide, and Rodenticide Act of 1947 (FIFRA). Under FIFRA, as amended in 1975 and 1978, there exists a complementary regulatory program to the pesticide registration procedure, i.e., a system of federal and state certification for commercial and private applicators "restricted use pesticides," as defined in Section 4 of FIFRA, 7 U.S.C. 136b. Essential features of this certification procedure, for both private and commercial applicators, include designation of a state administrative agency to establish applicator certification standards and for the Cooperative Extension Service to cooperatively design instructional manuals in a broad range of areas, including pest identification, pesticide selection and application, dissemination of pest management techniques, and discussion of environmental, legal, and safety issues. When establishing standards for certification, EPA must establish separate standards for commercial and private applicators. This study is focused exclusively on the private pesticide applicator training and certification programs in five states: Iowa, Nebraska, Pennsylvania, New York, and Georgia.

Applicator training and certification programs were first initiated in the states around 1975. Because the states have an individual responsibility for developing their own training and certification programs, a diversity of methods and materials for training applications for certification has resulted. In the current study, all training and certification is administered by the states with the exception of Nebraska, where certification is the current responsibility of the EPA Regional Office in Kansas City, Missouri. Since initiation of the training and certification program for private applicators, most states have completed the initial training and certification. States now offer sessions on a demand basis for new applicators and have begun the recertification process.

No evaluation of the private applicator training programs has ever been conducted on a large-scale multi-state basis. At the present time, the government is not completely cognizant of how well the states are complying with FIFRA and EPA standards and regulations in regard to the training and certification of pesticide applicators. There is currently no systematic model for use in evaluating the effectiveness of state-controlled programs, and the state programs themselves have lacked meaningful data on the impact of training among private pesticide applicators.

EPA needs to know if applicators believe that their pesticide use and handling practices have been effectively changed as a result of having participated in the training and certification process. The individual states have a need to know whether they have accomplished their objectives. In what areas have changes been initiated as a result of training and certification of pesticide applicators? How might the program capitalize upon its existing strengths to improve itself in preparation for recertification? Much of the information obtained from this project will be used to assist in developing new approaches and strategies for the continued certification and recertification of applicators. There will be a continuing need for objective data which can be utilized in making critical decisions about the direction and funding of the private applicator pesticide training and certification program.

While some states have performed evaluations of their own programs on a limited basis, the focus of these efforts has been narrow in scope. Furthermore, such state-level evaluations have concentrated primarily on changes in knowledge and not on perceived behavior changes, which are the focus of this evaluation. A pilot study for this project was conducted by EPA and the Council on Environmental Quality (CEQ) in 1978-79 in North Carolina. That study was used to refine research objectives and to pilot test instruments upon which the telephone survey instruments used in this study are partially based.

1.1 Research Design and Objectives

This project is designed to examine the current status of the private applicator training and certification programs in five selected states, and to assess perceived effectiveness of the training programs in influencing pesticide handling and usage practices among the private pesticide applicators trained and certified since the inception of the program. The evaluation will, among other concerns, examine the association between reported changes in pesticide handling and usage practices, and applicator training and certification program emphases, and types of training offered in the states. The ultimate goal of this project is to provide information for the improvement of these programs and for directing decisions regarding the federal role in the training and certification programs for users of restricted pesticides.

It should be noted at the outset that the five states participating in this study did so at their own initiative.[1] Although attempts were made to insure the participation of states which represented broad geographic and agricultural differences, it was the interest of the individual states in subjecting their programs to scrutiny--in the hopes of obtaining useful information on which to improve the operational emphases of their training programs (particularly recertification training)--which resulted in the participation of the five states represented here. Because of the interest demonstrated by each state in the evaluation, and the crucial role each state played in the formulation of the study design, questionnaire, and the interpretation of results, it is appropriate to acknowledge the significant contribution of each state lead agency and county extension service representatives in each of the states toward making the evaluation a successful and meaningful one.

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[1] Nebraska represented a somewhat unique exception to voluntary state participation because Nebraska is one of the two states (Colorado being the other) administered by the Environmental Protection Agency, Region VII, Toxics and Pesticide Branch. The University of Nebraska Training Coordinator for the state, however, did provide comment and input on the questionnaire design and on the draft final report.

It should be further noted that the states and their representatives played an important role in the formulation of the contents of the questionnaire for the study. In each state (with the exception of Nebraska, a state which entered the study shortly before data collection began), an Advisory Board was created. The Advisory Boards--represented by state lead agency, state cooperative extension service, chemical industry, and a grower representative--were visited by study staff early in the project, and members provided feedback on several versions of the questionnaire. This feedback process by each of the states in the study helped to insure that the questionnaire would be appropriate for each state, responsive to state data needs and evaluation interests, and would represent an acceptable--and feasible--range of questions on which the evaluation of the private pesticide applicator training and certification programs could be based.

In each state, measures of the private pesticide applicators were taken in four areas: reported differences since training in pesticide use and handling practices; attitudes regarding the private pesticide applicator training and certification program (i.e., its perceived value and worth) and the recertification program; training program characteristics; and individual background characteristics. The first two--behaviors and attitudes--are expected to reflect the type and degree of perceived impacts as a result of the program, and the second two are expected to serve as explanatory or mediating variables. The specific research questions on which the study is focused are:

- Background Profile--What are the characteristics of the certified private applicators in regard to a) farm size, b) principal crop, c) principal pest, d) education, e) age, f) years of pesticide experience, and g) annual pesticide expenditures?

- Behavior Profile--a) To what extent do growers feel that their pesticide handling practices have been affected by participation in the training and certification program? b) What are the current pesticide handling practices of those growers not affected by training for a given behavior? c) To what extent do these self-reported practices reflect safe and proper use of pesticides?

- Attitude Profile--What are the attitudes of applicators toward a) the training and certification program; and b) the recertification program?.

- Training Profile--What are the characteristics of the training program to which applicators were exposed, in regard to: a) year of training; b) training methods, and content; and c) certification requirements?

- Association of Variables--a) How do the background characteristics of certified private applicators vary across the five states? b) How do the program characteristics vary across the five states? c) How do growers' attitudes and reported behavior vary with program characteristics? d) How do growers' attitudes and behavior vary with background characteristics?

The research design which evolved for this project reflects the tradeoffs among conflicting demands to fulfill the research objectives within the practical constraints of the circumstances under which the data could be collected. What has emerged, as a result, is the best project research design that can be implemented: retrospective telephone interviews with growers. The major constraint imposed on this evaluation was the fact that the initial training and certification programs in each of the states had virtually been completed by the time the data collection instruments had received approval from the Office of Management and Budget. This precluded the taking of pretraining and posttraining measurements in the states and demanded a design which considered not actual measures of knowledge, attitude, or behavior changes as a result of training but self-reported perceived changes in behaviors and attitudes as provided by the participant growers in retrospect.[1]

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[1] The original design of this study was to involve pretest and posttest measures of knowledge, attitudes, and behavior. Given the timing of the approval on the original pretest/posttest questionnaires, it was possible to collect such data only on the last 100 private applicators receiving initial training in New York in March-April 1980. A special "Limited New York Pretest/Posttest Evaluation Study" describing the results of that effort is contained in the Appendix of this report.

Administered as an approximately 20-minute telephone interview, the study questionnaire obtained information on: respondent's background characteristics; pesticide use and frequency practices; perceived differences since training (if any) in pesticide use and handling practices; perceived value and worth of the training program, and the certification program; and the discrete methods of training to which the respondent was exposed. The questionnaire used in the study is contained in the Appendix to this report. The following provides an outline of the data which the questionnaire collected:

Introduction

- Screening questions to ensure that the respondent was certified as a private pesticide applicator; that he or she participated in either a training program or a self-study program before certification; and that he or she was currently an active grower or farmer.

Section I: Current Practices

- frequency of pesticide usage in past three years
- problem for which pesticides mostly are used
- behaviors below if no difference since training

Differences Since Training

- differences in pest identification
- differences in amount of crop damage allowed
- differences in methods of transporting pesticides
- differences in clothing worn while mixing and loading
- differences in clothing worn while spraying
- differences in frequency of calibration
- differences in methods of spray drift prevention
- differences in handling of pesticide spills
- differences in handling leftover pesticides
- differences in methods of empty pesticide container disposal
- differences in methods of pesticide and equipment storage

Section II: Training Worth: Advantages and Disadvantages

- rated importance of restricted pesticide certification program for private applicators
- rated value of private applicator training program
- perceived advantages of state private applicator training and certification program
- perceived disadvantages of state private applicator training and certification program
- principal source of assistance for pesticide use/information

Section III: Background Characteristics, Training Methods Received and Perceived Worth, Recertification Worth

- acres of land farmed (rented and owned)
- principal crops
- education
- age
- years of experience using pesticides
- amount spent on pesticides last year
- training session or self-study
- usage and usefulness of the following training elements:
  - slide/tape program
  - film or videotape
  - demonstration program
  - lecture
  - training manual
  - workbook
- year of initial certification
- year of certification expiration
- recertification status and plans
- perceived worth of recertification program
- reasons for not recertifying

Based on data for 2049 completed interviews, a number of analyses were performed, focusing primarily on analyzing the data for each of the individual state evaluations. The following summarizes the types of analyses which were performed for both the Comprehensive Evaluation Report, and each individual State Evaluation Report, which make up the body of this evaluation document:

- Analysis of Respondents' Background Characteristics
- Analysis of Training Program Characteristics
    - Program Description and Overall Assessment
    - Advantages and Disadvantages of the Program
    - Assessment of Individual Training Elements
    - Initial Certification and Assessment of Certification
    - Recertification Status and Assessment of Recertification
    - Training Assessment by Background Characteristics
- Analysis of Behavioral Characteristics: Scope and Specific Impacts in 11 Behavioral Areas Since Training
- Analysis of Reported Behavioral Impacts by Background Characteristics
- Analysis of Reported Behavioral Practices of respondents not affected by the training (Nonimpacted Respondents)

Before summarizing the major findings and recommendations of the study in Section 2.0, the data collection procedures used and the key constraints of the evaluation, which should be kept in mind when considering the study findings, are described in the following subsections.

1.2 Data Collection Procedures

Five states participated in the telephone survey of previously Certified Private Applicators upon which this evalution is based. These states are: Georgia, Iowa, Nebraska, New York, and Pennsylvania. Approximately 1,000 respondents in each state were selected from state lists[1] of certified applicators using Systematic Random Sampling.[2]

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[1] The approximate number of listings contained on each list of private applicators trained and certified in each state was as follows: Iowa: 51,000; Georgia: 40,000; Pennsylvania: 27,000; New York: 12,500; Nebraska: 43,000. The sample size of 1,000 respondents per state insures a confidence level of 95%.

[2] Georgia, Iowa, and Nebraska provided samples based on sampling specifications supplied by Abt Associates Inc. (AAI). AAI drew samples for New York and Pennsylvania from lists provided by these states.

In all cases except New York, the lists did not contain telephone numbers, and Abt Associates staff contacted Directory Assistance to obtain valid numbers and to update those in New York. During the survey period, attempts were made to contact the following numbers of potential respondents:

- Georgia - 919
- Iowa - 950
- Nebraska - 835
- Pennsylvania - 823
- New York - 741

Total 4,268

The five participating states represent differing geographic, climatic, agricultural, and programmatic characteristics (see Section 4.2). The total population of private applicators in these states is approximately 173,500; the estimated population of private certified applicators nationwide is estimated at two million.

Prior to survey implementation, a pretest was conducted by Abt Associates' Telephone Center with respondents in New York State; six interviews were completed. The purpose of the pretest was:

- To determine whether the questionnaire contained any ambiguously worded questions and to refine wording as needed;
- To ascertain whether respondents gave answers other than those pre-listed and to add additional answer categories as appropriate;
- To test the ease of administration of the instrument and the logic the wording of the questions, the sequence of the questions, and to make refinements as necessary; and
- To estimate the amount of time necessary to administer each interview and, thus, facilitate scheduling of the full-scale survey.

Prior to commencement of the interviewing period, interviewers and supervisors assigned to the study received a Training Manual and participated in two six-hour training sessions. (The Interviewer Training Manual is reproduced in the Appendix.) In these training sessions, interviewing protocol was thoroughly reviewed, and interviewers were trained in-depth on the particulars of this survey and given an opportunity to conduct mock interviews.

Interviewing for the full-scale survey began on March 18, 1981 and was completed on April 26, 1981. All interviews were conducted from Abt Associates' central telephone interviewing facility in Cambridge, Massachusetts, and were supervised for quality control on an on-going basis via a central monitor wired to the ten telephones in use.

Regularly scheduled interviewing took place Monday through Thursday from 5 p.m. to 9 p.m., on Saturday from 9 a.m. to 5 p.m., and on Sunday from 12 p.m. to 9 p.m. These interviewing hours were considered most efficient in terms of reaching respondents, while avoiding calling times that might be too disruptive to interviewees. Special arrangements were made to conduct interviews at other hours if needed or requested by respondents.

Three call attempts were made to each sampled respondent in an effort to obtain a completed interview. In 30% of the completed cases, an interview was obtained on the first contact. In 35% of the cases, the interview was obtained on the second contact, and on the third contact in 24% of the cases. In the remaining 11% of completed cases, interviews were conducted during subsequent callbacks at specified calling times. On average, the interview length was 18 minutes.

Completed interviews were obtained from 2049 respondents, with the final status of each sampled grower shown in Exhibit 1.2-1. Explanations of the status designations shown in Exhibit 1.2-1 follow.

Exhibit 1.2-1

Final Status of Sampled Respondents

	GEORGIA	IOWA	NEBRASKA	PENNSYLVANIA	NEW YORK	TOTAL
Sampled Respondents	919	950	835	823	741	4268
Interview Completed/	407	413	407	413	409	2049
Completion Rate[1]	44%	44%	49%	50%	55%	48%
Ineligible Respondents/	203	103	103	150	67	626
% Ineligible Respondents	22%	11%	12%	18%	9%	15%
Interviews Refused	28	116	96	55	10	305
% Interviews Refused	3%	12%	11%	7%	1%	7%
Non-working/	58	37	36	35	103	269
% Wrong Number	6%	4%	4%	4%	14%	6%
Respondent Unavailable	128	155	113	95	85	576
% Unavailable	14%	16%	13%	12%	12%	14%
Final No Contact	62	101	60	56	48	327
% No Contact	7%	11%	7%	7%	7%	8%
Other Final Status	33	25	20	19	19	116
% Other Final Status	4%	3%	2%	2%	3%	3%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

[1] Completion Rate indicates the proportion of completed interviews obtained from overall sample. See following page for Response Rate calculations.

Respondents were assigned an "Ineligible" status if they answered "No" to any one of three screening questions.[1] In 9 out of 10 cases where respondents were not eligible, it was because they were not active growers.

Respondents were assigned an "Ineligible" status if they answered "No" to any one of three screening questions.[1] In 9 out of 10 cases where respondents were not eligible, it was because they were not active farmers or growers.

When a respondent refused to participate in the survey, interviewers still attempted to establish eligibility by asking the screening questions. Also, respondents who preferred not to be interviewed were asked their reasons.

Of the 305 respondents who refused, 175 (57%) were willing to give reasons for refusal. These reasons and the percentage rates are shown in Exhibit 1.2-2. It is worth noting that the refusal rates were substantially lower in New York (1.3%) and Georgia (3.1%). These two states elected to send advance letters to certified private applicators in their states advising them of the survey and encouraging participation.

As indicated earlier, Abt Associates' interviewers attempted to obtain a current telephone number when none was provided on the state list. Still, in 269 cases the numbers available were not working or were the wrong numbers for the designated respondents. The status code "Respondent Unavailable" was assigned if the telephone number was answered, but the designated respondent was unavailable for the interview (e.g., away from home for an extended period). "Final No Contact" signifies that no one answered or that the line was continually busy. Of the sampled respondents, 116 were non-interviewable for other reasons (see Exhibit 1.2-3)

In order to calculate the response rate (i.e., the degree to which the survey succeeded in obtaining complete and usable data sets from potential respondents qualified to be in the sample), is is necessary to

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[1] Screening questions were: 1) "Have you ever been certified as a private pesticide applicator?"; 2) "Did you participate in either a training program or a self-study program before you were certified?"; and 3) "Are you now an active grower or farmer?"

Exhibit 1.2-2
Percent of Refusals and Reasons for Refusal

REASON FOR REFUSAL	REFUSALS	
	Number	Percent
1. Lack of interest	54	18%
2. Invasion of privacy/unwilling to give information over telephone	42	14%
3. Waste of time/lack of time	27	9%
4. Anti-government, EPA, or program	22	7%
5. Other answers	30	10%
6. Reasons not specified	130	43%

Exhibit 1.2-3
Other Reasons for Non-Interviews

	GEORGIA	IOWA	NEBRASKA	PENNSYLVANIA	NEW YORK	TOTAL
Deceased	16	11	8	11	8	54
Too ill/deaf	13	9	7	5	4	38
Moved out of state	2	3	0	2	4	11
Duplicate in sample	2	0	1	0	1	4
Do not do own spraying	0	2	4	1	0	7
Do not spray (organic farm)	0	0	0	0	1	1
Program instructor	0	0	0	0	1	1
Total	33	25	20	19	19	116

remove from the total number of potential respondents those who were not eligible to participate or who were "out-of-sample" for the "other" reasons shown in Exhibit 1.2-3. This non-qualifying computation is:

$$\text{Non-Qualifying Rate} = \frac{\text{Ineligible + Other Out-of-Sample}}{\text{Interview + Refusal + Ineligible + Other}}$$

The response rate is then computed as follows:

$$\text{Response Rate} = \frac{\text{Interview}}{\text{Total Sample-Ineligible-Other-(Nonworking Number + Respondent Unavailable + Final No Contact) X Non-Qualifying Rate)}}$$

The response rate for each state, based on the calculation above, is as follows:

	Response Rates
Georgia	68%
Iowa	54%
Nebraska	61%
Pennsylvania	68%
New York	67%
All States	63%

All completed questionnaires were thoroughly edited by Telephone Center Supervisors during the first week of interviewing and rapid feedback was provided to interviewers. In subsequent weeks, instruments received an edit scan before being forwarded to the Data Preparation Department. Completed questionnaires were coded by experienced Abt Associates coding clerks who were trained on the specific needs of this survey. Postcodes were developed by the Coding Supervisor, Survey Director, and Project Director. Data from completed surveys were entered and verified directly from the column-coded instruments into disc files on the Abt Associates in-house computer, using remote entry terminals. Survey data were thoroughly cleaned for out-of-range values and logical consistency before analysis began.

1.3 Constraints of the Evaluation

Estimates of error need to be considered whenever analyzing and interpreting the results of survey data. When assessing the accuracy of a survey, it is useful to distinguish between two types of errors: sampling errors and non-sampling errors.

The random sampling used in this survey allows the user of the statistics in this report to calculate sampling errors. Since the state-level statistics presented in this report are based on a sample, they differ somewhat from figures that would be obtained had a complete census been taken. However, the chances are about 95 out of 100 that an estimate which is a percentage from a sample will differ from a complete census by less than twice the standard error of the estimate. For example, if some sample proportion equals 20%, then the 95% confidence interval is 20% ± 3.9%. This means that 95 out of 100 times, the "true" value will be from 16.1% to 23.9%. Exhibit 1.2-4 provides confidence intervals for states included in this evaluation.

In this evaluation report, each state has been analyzed independently; therefore, no weights to compensate for disproportionate sampling rates were applied. While unweighted percentages are presented for the total five-state sample, no inferences are made to the total five-state population of private applicators. Respondents in the five-state sample are referred to in the text of this report as "the full study sample," "growers in the five states," and so forth. The reader should understand that all such terms refer to the respondent sample, not the five-state population.

Nonsampling errors include the effects of refusals, unavailable or unreachable respondents, as well as unreliable or invalid information provided by respondents. Also included are the effects of coding or other processing errors. Unlike sampling errors, there is no simple or direct way of estimating the extent of non-sampling errors; however, biases which can arise from various aspects of survey operations were minimized through strict control for high quality and consistency of data collection and processing.

Exhibit 1.2-4

95% Confidence Intervals for Percentages

	PERCENTAGE					
	5% or 95%	10% or 90%	20% or 80%	30% or 70%	40% or 60%	50%
GEORGIA (n=407)	±2.1%	±2.9%	±3.9%	±4.5%	±4.8%	±4.9%
IOWA (n=413)	±2.1%	±2.9%	±3.9%	±4.4%	±4.7%	±4.8%
NEBRASKA (n=407)	±2.1%	±2.9%	±3.9%	±4.5%	±4.8%	±4.9%
PENNSYLVANIA (n=413)	±2.1%	±2.9%	±3.9%	±4.4%	±4.7%	±4.8%
NEW YORK (n=409)	±2.1%	±2.9%	±3.9%	±4.4%	±4.7%	±4.8%

The survey statistics in this evaluation are also subject to the problems of nonresponse. Since virtually all survey efforts are limited by the resources that can be spent tracking respondents, interviews are completed with only part of the sampled respondents. It is important to bear in mind, when reading this report, that there may be differences between respondents interviewed (upon which the report is based) and the remaining portion of the sample population who for various reasons, were not interviewed.

2.0 SUMMARY OF MAJOR FINDINGS

If the goal of the pesticide private applicator training and certification program is to generate positive post-training differences in the care with which the grower selects, handles, applies, stores, and disposes of pesticides, the respondents in this study indicated that a significant level of goal achievement was accomplished through their respective state training programs. This impact was reported fairly evenly across respondents, regardless of age, level of educational attainment, year of initial certification, or number of acres farmed. In addition, those who reported applying pesticides more frequently appeared to have reported a greater number of behavioral impacts since training than the infrequent user; perhaps an appropriate and expected result of those who need the information benefiting the most.

Of particular interest is the finding that the method of training--whether by training session or through self-study--appears not to result in any significant differences either in the respondents' rating of the overall worth of training or in the number of reported behavioral impacts[1] as a result of training. Although the sample for the self-study method was relatively small, a close examination of the Pennsylvania correspondence course method suggests that the private pesticide applicator who completes formal self-study benefits as much as other applicators in the state who participate in training sessions. Further comparisons of the self-study and classroom methods reveal that among the better educated growers, those who train by self-study are more significantly impacted in the areas of crop damage allowed before treating with pesticides, clothing worn while mixing and loading pesticides, handling spills, pesticides, handling spills, and handling leftovers than are the comparable growers who were trained in sessions. The implications of this finding for recertification are clear: self-study offers a potentially cost-effective and administratively efficient alternative for accomplishing certification and recertification goals in states where the training sessions may be proving either cumbersome or expensive.

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[1] Eleven behavioral areas were examined: methods of pest identification; amount of crop damage allowed; methods of pesticide transportation; clothing worn while mixing and loading; clothing worn while spraying; frequency of equipment calibration; method of spray drift prevention; methods of handling spills; methods of handling leftovers; methods of pesticide container disposal; and methods of pesticide and equipment storage.

A third major, and potentially sensitive, finding is the degree to which respondents in the various states rely upon their chemical dealers or dealer representatives as the most likely source of information about which pesticide to use or how to use pesticides. Agricultural differences in the states and regions of the country account for some of the differences among states in the sample. In Iowa, where chemical dealer associations constitute an important role in advancing agricultural practices (and access to chemical dealers is reportedly more convenient for many growers), over 75% of the respondents reported being more likely to go to the chemical dealer than the county agent for information. In Georgia, exactly the opposite is true; nearly 75% of the Georgia growers rely on their county agents as the most likely source of information about pesticide use. Standing alone, this finding might be interpreted to be related simply to variations in the role of the chemical dealer associations in different states and the relative availability of county extension agents in each of the counties. However, it appears further that those respondents who reported going to their county agents for information on how to use pesticides, or what pesticides to use, also reported more significant impacts since training in their pesticide-related behaviors.

If the county agent relationship is as important as it appears--reinforced by the crucial role which the county extension service plays in delivering the pesticide private applicator training in the states--then the growers' reliance on chemical dealers may neutralize the potential influence of the county agent as a source of important information about pesticides; even where chemical dealers are trained in programs jointly held with county agents. The importance of this finding is reinforced further by the fact that the behaviors which the "county agent" respondents were most likely to report as being different since training were predominantly personal safety related. Behavioral areas having to do with: protective clothing worn while mixing, loading and spraying; and methods of handling spills and leftovers; spray drift prevention; and container storage were more significantly impacted than behaviors having to do with: methods of transportation of pesticides; amount of crop damage allowed; methods or frequency of calibration; and disposal of empty pesticide containers. Generally, where the individual grower's health was in jeopardy--as opposed to issues of amount of crop damage, calibration of equipment, or environmental protection--the most significant impacts among those who relied on their county agents were found. From a programmatic perspective, it appears that the county extension agent plays a key role in influencing pesticide-related behaviors beyond providing the private pesticide applicator training.

In addition to these major findings, a number of other important findings resulted from this examination of five state private pesticide applicator training and certification programs. The remaining findings and related recommendations cluster into four major categories--methods, materials, content, and organizational objectives--each reviewed separately below.

Training Methods

As mentioned above, there appears to be no significant difference, in terms of number of impacts reported since training, between respondents who were trained in the self-study method versus the training session method. Moreover, in terms of particular training elements, for example use of a workbook or manual, the self-study respondents tended to rate the value of these materials slightly higher than did the training session respondents. In part, this difference in perceived value of the written materials relates directly to the reliance the respondents have to place on the materials; if the self-study manual was the only source of assistance, one could expect it to be rated as fairly valuable in the context of the training and certification requirements. These differences between the self-study and training session respondents are insignificant, however. Because of the relatively large number of respondents in Pennsylvania who reported being trained by the self-study method, a closer examination of this training method option was possible, and is described and assessed in detail in Section 7.4 of the Pennsylvania Evaluation Report.

It should be remembered that the pure "self-study" correspondence method which is used in Pennsylvania is not the only training method which is available beyond the group training sessions. In Georgia, for example, initially large numbers of growers seeking certification were trained in classroom settings. Later, when single or small numbers of growers desired training and certification, a self-study option--which is completed not by correspondence, but under the direct supervision of the county extension agent--was designed. The Georgia model of "self-use" machines (which play an adaptation of the Colorado slide/tape series) is one which permits ease of flexibility where the numbers of growers demanding training is relatively small, but still preserves the one-on-one training supervision and contact between the grower and the county agent.

It is apparent that the "self-use" machine produces no differential effect in terms of reported behavioral changes; the grower in Georgia who was trained later (when county agents began to adapt the self-use machine) is equally likely to report (or, for that matter remember) impact since training as the grower who was trained during the earlier years when the training session was dominant. There was no evidence that the earlier trained had difficulty remembering the training experience. In the final analysis, therefore, it may make little difference if the self-study method adopted is modeled on the Pennsylvania self-study correspondence course or the Georgia "self-use" machine; self-study appears to be a viable option to the organization and delivery of pesticide private applicator training sessions and may save considerable administrative and county extension service time if the self-study method were considered for recertification.

In fact, many of the states--including New York--originally developed their training manuals to permit the self-study option. In these states particularly, the self-study option may be most viable. Where self-study is an attractive option to the state for purposes of recertification, assistance may be needed in the design and development of a self-study manual or adoption of the type of self-use machine which Georgia now uses. However, the development of these options, if underaken by the states from a zero base, may prove to be a costly alternative to the more traditional training session delivery system.

Materials

The materials used in the states are fairly standard. Most use a modified version of the EPA Core Manual or the Northeastern Core Manual coupled with either the Colorado Slide/Tape Series, along with demonstrations, films and exercises to particularly emphasize pest identification and calibration. The demonstrations and exercises are generally reported to be more worthwhile than the written materials. The training activities which involved the growers more directly in training tended to be rated of greater value than those which do not, which accounts for the less enthusiastic appeal of lecture methods, and reflects a common training phenomenon: the more involved the trainee is in the training, the more likely he or she will remember it and benefit by it. Where the self-study option is utilized, this involvement in training through demonstration or exercises is minimized. In Georgia, however, the county extension agent who supervises the use of the self-use machines also provides an exercise on the reading of labels, and this interaction between grower and county agent may provide the additional reinforcement which is obviously missing in a totally correspondence course.

Changes in agricultural practices and pesticide use and handling laws and regulations make the Colorado slide/tape series modestly outdated. Adaptations of the series have been undertaken in most states, but an update of the series on a national level--emphasizing changes since private pesticide applicator training was initiated--would probably be helpful to most states. In states interested in adopting a self-study method for recertification, a revised EPA Core Manual permitting self-study would probably also be welcome in saving considerable duplication across the states in the development of self-study materials.

Content

The respondents to the study more often reported differences since training in personal safety behaviors than differences since training in behaviors relating to protection of the environment or other areas. The two areas of greatest perceived impact attributable to training include: (1) clothing worn while mixing and loading; and (2) methods of handling spills on clothing or skin. The methods of container disposal, spray drift prevention, and handling leftovers were also high in the rank-order of areas most greatly impacted. Among those areas where relatively small percentages of respondents reported perceived impacts attributable to training were the amount of crop damage allowed, transportation of pesticides, and pest identification. In some cases, the lack of significant impact in these areas appears to have more to do with the fact that respondents reported acceptable behaviors in these areas before training; for example, most everyone reported carrying their pesticides in the bed of their truck or trunk of their car. Nonetheless, respondents did indicate some pre-training behaviors which they believed to be acceptable which are, at best, questionnable; for example, disposing of empty pesticide container at the town dump (not a designated area or safety land fill area). Information in each of the state evaluation reports points to those content areas where emphasis during recertification would probably be appropriate.

In general, the study findings indicate that emphasis is needed during recertification in the following areas:

- clothing worn while spraying
- frequency of equipment calibration
- methods of handling leftovers
- methods of container disposal
- methods of pesticide and equipment storage

Organizational Objectives

Section 23 of FIFRA, in addition to authorizing cooperative agreements between EPA and the states, provided for EPA to "utilize the services of the Cooperative State Extension Services for informing farmers of accepted uses and regulations." Congress spelled out both the organization of the private (and commercial) pesticide applicator training and certification program as well as specifying the mechanisms for its implementation; the state Cooperative Extension Service (CES) would be enlisted to perform the educational functions, while state lead agencies would be responsible for developing plans to administering certification programs. Nowhere in this organization and delivery mechanism did Congress anticipate the active role of the chemical dealers in providing pesticide use and handling information to growers. The respondent growers in each state who were most significantly influenced in their pesticide choice and pesticide use behaviors were those who were most likely to rely on their extension agent for information. Growers in the two midwestern states were least likely to rely on their county agents or to be influenced in their pesticide use and handling practices. The growers in Iowa and Nebraska generally are not using restricted pesticides to the degree that growers in the eastern states are, and consequently their needs for pesticide use and handling practice information may differ.

In fact, respondents in Iowa and Nebraska reported finding the pesticide private applicator training and certification program to be less worthwhile and less important than did other respondents in the study. Certainly this reportedly higher level of dissatisfaction with the program is due, in part, to the fact that many of the pesticides used in Iowa and Nebraska are not restricted, yet the training and certification requirements are the same as in other states. In Iowa, for example, the growers were warned early during program inception that training and recertification would be required to utilize certain pesticides. In fact, these pesticides never became restricted, yet hundreds of growers went through the inconvenience and cost of becoming certified as private pesticide applicators. Unfortunately, even for those pesticides which are not restricted, a certain amount of pesticide usage and handling training is probably important; either from the perspective of personal safety or environmental safety. However, since the emphasis of training is on certifying the growers as being competent to use restricted use pesticides, growers in states where restricted use pesticides are uncommon express a degree of frustration with state requirements to be trained and certified. In Nebraska, which is also in Region VII of EPA, a major political battle was reportedly waged from 1975 to 1978 between the Nebraska Legislature, EPA, and the Nebraska Department of Agriculture. According to the Nebraska training coordinator, a considerable amount of publicity ensued from this conflict and most of it was anti-federal government, anti-EPA, and anti-pesticide training. The training coordinator in Nebraska believes there is considerable carry-over of this antagonism in the state, and that this attitude has been difficult to overcome since EPA has come into the state to be the regulatory agency.

From an organizational perspective, the inconvenience (and sometimes fees) imposed on growers who do not use restricted pesticides probably heightens their sense of frustration; and perhaps even explains, in part, why so many of the growers in the Midwest indicate they would be more likely to go to their chemical dealer. This suggests that training and certification--and certainly recertification--should be directly related to the growers' agricultural practices and use of particular pesticides. However, where growers' health and environmental safety are at issue, continued training of some type is obviously preferable to no training, and even the growers in states with limited restricted use pesticides reported significant positive behavioral changes as a result of their participation in the state private applicator training and certification program.

In the following major chapters of this report, the analyses related to the Comprehensive Evaluation Report and each of the five state evaluation reports are described in detail.

3.0 STATE PROFILES

This chapter provides a summary profile of each of the private pesticide applicator training and certification programs whose trainees were surveyed. Each profile is based upon information provided by each state training coordinator and consists of four subsections: Overview; Organization; Training; and Certification-Recertification. The profiles are not intended to be comprehensive in nature; rather, they offer a convenient means of comparing and contrasting the various program contents and formats across the five states. The individual state programs are discussed and evaluated separately and are contained in the Appendix to the Final Report. The Comprehensive Evaluation of all five training programs is provided in Section 4.0.

Exhibit 3-1, which introduces the individual state profiles, provides a snapshot overview of all five state programs. As shown in the profiles, all of the State Private Applicator Training and Certification Programs use either a core training manual and/or a slide/tape series. States also use either the EPA Core Manual, the Northeastern Core Manual--which includes greater detail than the EPA Core Manual--or a manual particular to the state, like Pennsylvania's Manual which is especially designed for "self-study." All of the programs, except New York, present the Colorado Slide/Tape Series; New York uses its own slide/tape series based on the Northeastern Core Manual. Also, all of the programs supplement these materials with exercises and/or demonstrations, particularly in the areas of calibration, label comprehension, and pest identification.

Exhibit 3-1

State Program Overview

	Number Counties / Number of Training Sites (Estimate)	Year Training and Certification Program Initiated	Number Trained & Certified by 1980	Est. % of All Growers Certified By 1981	Est. Number Recertified Growers	Principal Crops	Commonly Used Pesticides	Training Required	Exam Required	Fee Required	Key Format and Training Characteristics	Topics Emphasized	Home Study/ Self-Study Option
Georgia	159/157	1976-1977	33,000	78%	2,700	Corn, Soybeans, Peanuts, Tobacco Cotton	Methomyl, Paraquat, Parathion, Guthion	Yes	No	None	• Colorado Slide/Tape Series Adapted to Self-Use Machine • "Understanding Labels" Non-Scored Questionnaire	• Labels • Calibration	Yes (But Rarely Used)
Iowa	100/100	1976	63,200	90%	10,942	Corn, Soybeans	Counter, Thimet, Dydfnate, Mudap, Furadan	Yes	No	$5	• EPA Manual (Iowa supplies) • Lecture with Calibration and Label Exercises • Colorado Slide/Tape Series • Demonstrations on Calibration and Pest Identification	• Safety in Handling, Mixing and Application	Exam without Training Option Rarely Used
Nebraska	91/900	1977	45,300	Almost 100%	24,000	Corn, Wheat	Ramrod, 2-4D, Furadan, Counter, Thimet	Yes	No	None	• Colorado Slide/Tape Series • EPA Core Manual and Lecture • Supplemental Workbook • Calibration Exercise	• Calibration • Storage • Disposal	Yes (But Rarely Used)
Pennsylvania	67/65	1976	30,610	90%	15,000	Corn, Vegetables Flowers, Hay crops	Atrazine, Lasso,	No	Yes	None	• Self-Study from Penn. Core Manual w/Self-Admin. Exam • Sessions Using Colorado Slide/Tapes/Lectures with Open-book Exam	• Labels • Safety in Use and Handling • Calibration	Yes (Est. 95%)
New York	62/60 t.	1975	13,260	75%	Begins 1984	Corn, Fruit, Vegetables	Counter, Guthion, Carbofuran, Parathion	No (Self-Study Option Exists	Yes	$15	• Northeast Core Manual • Film on Pesticide Safety • Northeastern Core Slide Series w/ Trial Exam and Discussion • Self-Study/Home Study Option Based on Northeast Core Manual	• Labels • Envir. Hazards • Safety in Use, Storage and Disposal • Drift Control	Yes (Est. 15%)

GEORGIA STATE PROFILE

OVERVIEW

Number of counties: 159

Number of growers trained and certified, by year:

- 1976-77: 23,000
- 1978: 7,000
- 1979: 1,500
- 1980: 1,500
- 1981 (estimate): 1,500

Percentage of all growers certified, as of 1981: 82%

Number of recertified growers: (Recertification deadline is October 1982; 2700 recertified to date.

Major crops: Corn, soybeans, peanuts, tobacco, cotton.

Main problem areas: There appears to be a tendency for growers to put off fulfillment of recertification requirements. Program staff are concerned that some growers may choose to ignore recertification altogether, and will be required to take initial certification training over again.

Key program changes since inception: Increasing use after 1979 of machines which enable growers to self-administer the Colorado Slide/Tape Series.

Planned changes: General expansion of EPA Core manual (to be used beginning October, 1982), plus updating of the Colorado Slide/Tape Series after October, 1982.

Training required: Yes.

Certification exam required: No.

ORGANIZATION AND ADMINISTRATION

Key agencies and responsibilities: Cooperative Extension Service (CES) (main office at University of Georgia, Athens): responsible for establishing, maintaining, and reviewing training program content and implementation.

Georgia Department of Agriculture (DOA): responsible for issuing licenses, maintaining records, and notifying growers about recertification deadlines and obligations.

Key actors:

CES: Burton Evans, Extension Entomologist and Director of Private Applicator Pesticide Training Program.

District Agents: CES divides Georgia's counties into five districts, each directed by a District Agent. District Agents serve to facilitate information flow between CES' main offices in Athens and the counties within their respective districts.

DOA: Ron Conley, Director of the Pesticide Division of DOA and State Lead Agent in charge of certification procedures and records.

TRAINING

Format and materials:

Standardized program materials are used throughout the state: 1) Colorado Slide/Tape Series (two hours); 2) questionnaire on "Understanding Labels" (one-half hour); 3) EPA Core Manuals are distributed to all growers. The "label exercise" covers warning statements, mixing directions, accident procedures and symbols. "Self-use" machines for the Colorado Slide/Tape Series are available in each CES office. These allow a trainee to view the Colorado Slide/Tape Series at the local County Extension office without constant supervision by the County Agent. Following the slide/tape series, the trainer or office secretary administers the label questionnaire to the grower. The questionnaire is not assigned a "pass/fail" grade; rather, the County Agent thoroughly reviews all problem areas with the trainee following the the exercise.

Alternative training methods available:

Very rarely, a grower will opt to complete a "Programmed Learning" workbook in lieu of training. This is a self-study question-and-answer exercise based on the EPA Core Manual, and available on request in all county offices.

Changes in training format:

Initially, sessions were held in each county with 25-40 trainees per session. Presently, however, 90% of all trainees are trained individually in each respective county. Initial training sessions included a presentation by the County Agent of the Colorado Slide/Tape Series, followed by completion of the label questionnaire. As the number of initial trainees declines, Cooperative Extension began to use "self-use" machines, a program which can be set up and administered by the office secretary.

Key topics emphasized in training:	Understanding labels and calibration.
Program variations within the state:	None.

CERTIFICATION AND RECERTIFICATION

Certification Requirements:	Certification status is achieved by fulfilling any one of the following requirements: 1) attend training (view the Colorado Slide/Tape Series and complete questionnaire on "Understanding Labels"); 2) complete Programmed Learning; 3) pass an examination. Nearly all applicants opt for training.
Recertification procedure:	Recertification is required every five years. The state's first recertification deadline is October, 1982. Recertification is achieved by accumulating three or more hours of "credit" over the five-year period. One hour of credit is received for attending a CES grower meeting or one or more hours' credit is received for attending an association society meeting or short course which has been recommended by CES and approved by DOA as containing appropriate relevant information. These meetings are held frequently. Upon completion of a credit, a county agent or other approved agent mails a form to DOA notifying that agency of his attendance and the number of hours earned.
Recertification notification:	DOA is responsible for mailing a letter to each grower 15 months prior to the recertification deadline. This letter informs the grower of his/her current status and the upcoming deadline date. Another letter is mailed 90 days prior to the recertification deadline to inform the grower if he has not completed recertification requirements and notifying him of his options.
Certification/ Recertification fee(s):	None.

NEW YORK STATE PROFILE

OVERVIEW

Number of counties:	62
Number of growers trained and certified, by year:	• 1975: 7,560 • 1976: 2,870 • 1977: 910 • 1978: 690 • 1979: 570 • 1980: 660 • 1981 (estimate): 750
Percentage of all growers certified as of 1981:	78%
Number of recertified growers:	None (recertification begins in 1984).
Major crops:	Fruits, corn, vegetables, forage crops.
Main problem areas:	The computer file-system for the input, access and interpretation of applicants' certification records has not always operated smoothly. Data are sometimes unavailable or difficult to interpret.
Key program changes since inception:	Initially, all growers attended training sessions regularly scheduled in their own county. Presently, decreasing number of applicants has led to 2-4 counties holding a single session, as needed. Only 85% of all applicants attend sessions. The remaining 15% are certified via self-study.
Planned changes:	The certification exam will be upgraded, requiring more knowledge in the safety areas of calibration, disposal, and drift.
Training required:	No. Growers may take a "self-study" training course in lieu of regular training; about 15% of all growers are certified by self-study.
Certification exam required:	Yes.

ORGANIZATION AND ADMINISTRATION

Key agencies and responsibilities:

Cooperative Extension Service (CES) Specialists in the Chemicals-Pesticide Program (main office at Cornell University, Ithaca, New York). Responsible for establishing and maintaining program content and implementation, including updating of materials.

New York State Department of Environmental Conservation (DEC): responsible for issuing licenses, maintaining records, and mailing recertification workbooks to certified growers. Also works with CES in revising certification exam.

Key actors:

CES: James Dewey, Director of the Chemicals-Pesticides Program at Cornell University.

DEC: Ray Malkiewicz, State Lead Agent, and John Wainwright, DEC Coordinator of Records and Exams. DEC employs 12 agents responsible for administering certification exams throughout the state.

TRAINING

Format and materials:

Training is conducted by CES Agents in a two-part program. Part I: A trainee attends a meeting at his local CES office to pick up a copy of the Northeastern Core Manual and to view a film on pesticide safety. Part II: Three to four weeks after the initial meeting, trainees meet again to discuss the manual with their agent and to view a 20-minute slide series based on the Northeastern Core Manual and emphasizing accident-avoidance procedures. Trainees are then given a 25-question "trial exam" and problem areas are reviewed. Review is immediately followed by a 50-question state certification exam administered by a DEC Inspector.

(The Northeastern Core Manual includes the same topics as the EPA Core Manual, but its level of detail is greater.)

Alternative training methods available:

Self-study Program (also known as "home-study"): this alternative to attending training sessions involves picking up a Northeastern Core Manual from the local CES Office, studying it, and then taking the certification exam, either at a regularly scheduled session or by private arrangement with a DEC inspector. The manual is especially designed for self-study use.

Changes in training format: The only change is the increasing trend towards self-study (from 1% of all trainees in the early stages of the program to 15% today).

Key topics emphasized in training: Labels; hazards to environment, wildlife, and consumers; safe use, storage, and diposal; calibration drift; and operational procedures.

Program variations within the state: In the early stages of the program, ten individual training sessions were held in the southeastern portion of the state for the large number of non-English speaking growers in the region. This is no longer necessary as these certified growers tend to assist newcomers with similar language barriers.

CERTIFICATION AND RECERTIFICATION

Certification requirements: Training is not required, but all applicants must pass a 50 question exam to achieve certification. The exam may be reduced to 40 questions of greater difficulty in 1982 or 1983.

Recertification procedure: Recertification is required every six years. The state's first recertification deadline will be in the Fall of 1984. Recertification is achieved by completing a Pesticides Safety Workbook which is mailed to previously certified growers by DEC. The completed Workbook is then mailed back to the DEC Office for recertification approval. If an insufficient number of questions are answered correctly, the grower is notified that he must again complete the Workbook. The Workbook is currently being designed by CES and DEC.

Recertification notification: DEC will send a notification card to prevously certified growers.

Certification/ Recertification fee(s): $15.00 every three years.

PENNSYLVANIA STATE PROFILE

OVERVIEW

Number of counties:	67
Number of growers trained and certified, by year:	• 1976 - Feb., 1978: 17,500 • March, 1978 - Dec., 1978: 8,200 • 1979: 2,460 • 1980: 2,450 • 1981 (estimate): 2,200
Percentage of all growers certified as of 1981:	90%
Number of recertified growers:	Approximately 15,000.
Major crops:	Corn, forage crops, dairy, fruite, vegetables, nursery crops.
Main problem areas:	None.
Key program changes since inception:	The percentage of growers who take self-study correspondence training for certification has risen from 50% in 1976 to 95% in 1981.
Planned changes:	None.
Training required:	No.
Certification exam required:	Yes ("open-book" examination).

ORGANIZATION AND ADMINISTRATION

Key agencies and ressponsibilities:	Cooperative Extension Service (CES) (main office at College of Agriculture, Pennsylvania State University in University Park, Pennsylvania): responsible for designing and implementing training program. Also responsible for reviewing and coordinating various state and local government and industry programs designed to aid growers in pesticide-related activities.

Pennsylvania Department of Agriculture (PDA): state lead agency responsible for issuing applicator permits. Also conducts training sessions in cooperation with the CES. These sessions are not for fulfillment of initial certification requirements; rather, they are in conjunction with the state's overall promotion of pesticide safety.

Key actors: CES: Winand K. Bock, Extension Pesticides Specialist (Pennsylvania State University) and Coordinator of Pesticide Applicator Training Programs.

DOA: Gerard Florentine, Pesticides Operations Coordinator of DOA'S Bureau of Plant Industry. DOA employs ten pesticide inspectors throughout the state to carry out and coordinate certification procedures and regulations.

TRAINING

Format and materials: To participate in the self-study correspondence program, each grower receives a copy of the state's individualized study manual ("Pest Management and Environmental Quality") as well as a 75-question exam based on the manual and a computerized answer sheet. The applicant then completes the exam at his own pace and mails the completed answer sheet to the Department of Agriculture for certification approval (contingent on passing the exam). About 98% of self-study applicants pass the exam.

Alternative training methods available: Applicants have the option of attending group sessions administered by the CES. These sessions last several hours and incorporate lectures, possibly portions of the Colorado Slide/Tape Series, and possibly demonstrations. The state certification exam is then administered in an "open-book" fashion.

Changes in training format: In 1980, the Study Manual was updated to include changes in EPA policy and regulations, as well as recently accepted standard safety measures which have replaced outdated methods. Approximately 10% of its contents was revised.

Key topics emphasized in training: Proper use and handling of pesticides; label comprehension; safety and equipment; laws and regulations; application; maintenance and calibration; integrated pest management.

Program variations within the state: Training elements (e.g., slide/tape and demonstrations) offered at discretion of county extension agent.

CERTIFICATION AND RECERTIFICATION

Certification Requirements:	Pass examination (75 questions, "open-book").
Recertification procedure:	Recertification is required every three years. The state's initial recertification deadline was September, 1980. To recertify, a grower must attend at least one "Update Training Session" during the three-year period. Any informational or instructional meeting offered by industrial groups, agricultural chemical groups, CES, or PDA which meets an individual's needs in "pest management management in the broadest sense" qualifies as an Update Training Session. Update training certificates are available upon completion of the training meeting.
Recertification notification:	Five months prior to a grower's certification expiration date, PDA mails a postcard specifying the recertification requirements and deadline.
Certification/ Recertification fee(s):	Training manual: $6.00 Certification: None Recertification: None

NEBRASKA STATE PROFILE

OVERVIEW

Number of counties:	91
Number of growers trained and certified, by year:	● 1977: 37,000 ● 1978: 7,000 ● 1979: 900 ● 1980: 400; ● 1981 (estimate): 5,000
Percentage of all growers certified as of 1981:	Almost 100%
Number of recertified growers:	As of May, 1981, 24,000 have been recertified; deadline is December, 1981.
Major crops:	Corn, wheat (grain sorghum), soybeans.
Main problem areas:	None.
Key program changes since inception:	None.
Planned changes:	Update slide/tape series to reflect new laws and regulations and new equipment and safety methods.
Training required:	Yes.
Certification exam required:	No.

ORGANIZATION AND ADMINISTRATION

Key agencies and responsibilities:	Cooperative Extension Service (CES) (main office at University of Nebraska, Lincoln): responsible for establishing and maintaining training, and reviewing and updating materials. CES maintains a Pesticide Advisory Committee consisting of 12 staff members from the Institute of Agricultural and Natural Resources at the University. The Advisory Committee has been most active during the initial stages of the training and recertification programs.

Environmental Protection Agency (EPA) Regional Office in Kansas City: responsible for issuing certification credentials and enforcement of regulations. The state is divided into five districts. (Nebraska and Colorado are the only states in the country whose certification programs are administered by EPA. All other states' certification programs are conducted by the State Department of Agriculture.)

Key actors: CES: Emery Nelson, Director of Pesticide Applicator Training Program, University of Nebraska.

EPA: Leo Alderman, Chief, Enforcement Section; C.E. Poindexter, Chief, Program Support Section.

TRAINING

Format and materials: Training sessions are conducted at any one of ten sites in each county. Each session includes a presentation of the Colorado Slide/Tape Series supplemented by the EPA Core Manual for review and discussion. In addition, the state has developed its own Workbook to highlight the slide/ tape series. Also, about 20% of the agents use an exercise in calibration methods. This exercise is not formalized, rather, its presentation varies depending on the County Agent's perception of the growers' needs.

Alternative training methods available: Although a self-study workbook and examination are available as options to training (and recertification) they are seldom selected by the grower for initial training.

Changes in training format: In 1981, the Slide/Tape Series and Workbook have been updated to reflect changes in law, calibration methods, pesticides safety, and application equipment.

Key topics emphasized in training: Calibration; storage; disposal; pesticide regulations/law.

Program variations within the state: Each county agent has latitude to devote more time to the pest(s) most prevalent in their respective counties.

CERTIFICATION AND RECERTIFICATION

Certification Requirements:	Attend training session.
Recertification procedure:	Recertification is required every three years. December, 1981 is the first recertification deadline. Recertification status is achieved by attending a training session conducted at a CES office. These sessions consist of a Workbook Exercise and a Slide/Tape Presentation, both of which are complimentary to the original training.
Recertification notification:	Individual notices to growers are not used. Instead, CES conducts a media campaign (radio, newspapers) and uses newsletters to inform growers of recertification needs.
Certification/ Recertification fee(s):	None.

IOWA STATE PROFILE

OVERVIEW

Number of counties: 100

Number of growers trained and certified, by year:

- 1976: 15,000
- 1977: 43,000
- 1978 4,000
- 1979: 300
- 1980: 300
- 1981 (estimate): 350

Percentage of all growers certified, as of 1981: 90%

Number of recertified growers: 10,942 since 1979; Deadline is December, 1981.

Major crops: Corn, soybeans

Main problem areas:

- Materials become outdated in the areas of application procedures or safety measures and funds do not exist to adequately update these materials.

- Several sections of the Colorado Slide/Tape Series do not apply to Iowa's pest control situation and no plans exist to update these materials.

Key program changes since inception: In the early years of the program, recertification requirements were informal and ambiguous; recently, requirements have been formalized.

Planned changes:

- Revise slide sets, particularly in areas of calibration, application, reduced tillage, and integrated pest management.

- Offer recertification training at initial certification training sessions.

Training required: Growers may take an examination in lieu of training, but very few growers choose to take this examination.

Certification exam required: No.

ORGANIZATION AND ADMINISTRATION

Key agencies and responsibilities:	Cooperative Extension Service (CES) (main office at Iowa State University, Ames): responsible for implementing and maintaining training program, reviewing materials, and disseminating relevant information. Iowa Department of Agriculture (DOA): responsible for keeping certification and recertification records, collecting fees, issuing certification cards, and enforcement. Also responsible for reviewing slide series section on laws and regulations.
Key actors:	CES: Harold R. Stockdale, Director of the Pesticides Applicator Training Program; Linda Buntin, Pesticides Applicator Training Specialist. DOA: Myron Van Cleeve, Director of Pesticides Division, Don Doxon, Assistant Director.

TRAINING

Format and materials:	Training is conducted by a County Extension Agent in group sessions. Each session includes a slide presentation (Colorado Series) accompanied by a lecture (not a tape). During the lecture, trainees may refer to Iowa's Core Manual (based on the EPA Core Manual with added or deleted text depending on relevancy to Iowa's needs). Also, agents often give demonstrations on calibration equipment or pest identification.
Alternative training methods available:	None.
Changes in training format:	In 1979, the training program began to offer education in integrated pest management. This concept stresses the joint use of two or more pest control methods; for example, the use of biological control agents coupled with the use of selective pesticides.
Key topics emphasized in training:	Safety (handling, mixing, application).
Program variations within state:	None formally, although regions of the state that are oriented predominantly towards either livestock or alfalfa receive training emphasis in pest and drift control.

CERTIFICATION AND RECERTIFICATION

Certification Requirements:	Attend training session.
Recertification procedure:	Recertification is required every three years. December, 1981 is the first recertification deadline. Recertification status is achieved by attending a training session conducted at a CES office. These sessions consist of a Workbook Exercise and a Slide/Tape Presentation, both of which are complimentary to the original training.
Recertification notification:	Individual notices to growers are not used. Instead, CES conducts a media campaign (radio, newspapers) and use newsletters to inform growers of recertification needs.
Certification/ Recertification fee(s):	None.

4.0 COMPREHENSIVE EVALUATION REPORT

Contained in this chapter are the analyses and findings based upon the data reported by all 2049 respondents in the study, approximately 400 respondents from each of the five states: Iowa, Nebraska, Pennsylvania, New York, and Georgia. Although some attempt has been made to draw out observations which reflect the private applicator pesticide training and certification program practices nationwide, caution should be exercised in extending the study findings indiscriminately or too broadly. The sample states do represent a nicely balanced mix of states (in terms of background characteristics and pesticide experience and usage), and the states themselves represent a good range of geographic and agricultural differences, such that the study findings may be at least suggestive of some fairly typical patterns, behaviors, and impacts.[1] The study data provide helpful indications of the types of training activities considered worthwhile, and the behavioral areas which were reported to be most greatly affected in the study states, so that these states may better plan recertification programs which meet federal, state, and grower needs.

In Section 4.2 the general training characteristics of the state programs (as reported by the respondents) are considered in light of the respondents' assessment of the training's overall worth as well as the assessed worth of individual training elements. The respondents' assessment of the certification and recertification program are also considered along with an analysis which examines the potential relationship between the respondents' background characteristics and assessment of training.

In Section 4.3 a comprehensive assessment is provided of the reported behavioral impacts of the private applicator training and certification program. The analysis of particular behavioral impacts provides essential information regarding the behavioral areas which were reported to be most significantly affected by training, and those particular behavioral areas and pesticide use practices which appear to be less affected. These reported behavioral impacts are then assessed in terms of the background characteristics of the respondents and the training characteristics of the programs to test the uniformity of impacts across all types of respondents and programs. Perhaps most importantly, the section ends with an analysis of the reported behavioral practices of those respondents who for a given practice said they were not impacted by training. In this final section of the Comprehensive Evaluation Report, the reported pretraining behaviors of the nonimpacted respondents are analyzed to determine whether or not the absence of a behavioral difference since training was related to the fact that the respondent already exhibited acceptable behaviors prior to training, or whether the training programs simply failed to communicate the necessary changes in behavior to respondents. Section 4.3.4 concludes with a summary of the reported behavioral impacts in the five states.

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[1] Efforts were made to procure balanced geographic distribution of study states. However, because state participation ultimately hinged upon the maturity of the training and certification process (i.e., numbers trained and certified) and state willingness to participate, an absolute balance in geographic representation was not possible.

In the section which follows, the background characteristics of the entire sample are discussed and compared across the individual states.

4.1 Analysis of Background Characteristics

A total of 2049 private pesticide applicators responded to the survey of previously trained and certified private applicators in the five study states. The Georgia and Nebraska samples each contained 407 respondents, the New York sample was 409, and the Pennsylvania and Iowa samples each had 413. The exhibits and the discussion which follow summarize the characteristics of the respondents for the whole sample, highlighting especially interesting state differences. Many of the original response categories have been aggregated for comparison purposes. For greater detail, the reader is referred to each individual state evaluation report, Appendices A to E.

Age of Respondent - The first background characteristic listed in Exhibit 4.1-1, age, shows that two out of three of the respondents were age 45 or above. The entire sample was rather evenly distributed into

Exhibit 4.1-1

Private Pesticide Applicator Background Characteristics
(Re-percentaged to exclude missing data)

	Georgia (407)	New York (409)	Penn. (413)	Nebraska (407)	Iowa (413)	Total (2049)
1. AGE (%)						
34 years and under	18	28	27	25	24	24
35 to 44 years	23	25	24	22	26	24
45 to 54 years	26	27	26	30	29	28
55 years and over	33	20	23	23	21	24
2. EDUCATION (%)						
Less than H.S. graduate	32	13	24	16	14	20
High school graduate	32	42	43	53	52	44
More than H.S. graduate	36	45	33	31	34	36
3. SIZE OF FARM (%)						
100 acres or less	46	38	44	5	5	28
101 to 500 acres	36	45	49	49	63	48
501 acres or more	18	17	7	46	32	24
4. PESTICIDE EXPERIENCE (%)						
10 years or less	28	29	37	28	32	31
11 to 20 years	34	33	30	40	44	36
21 years or more	38	38	33	32	24	33
5. FREQUENCY OF PESTICIDE USAGE (%)						
Once a year or less	15	28	29	28	49	30
Two to five times a year	44	25	35	54	40	39
Six times a year or more	41	47	36	18	11	31
6. PESTICIDE EXPENDITURES (%)						
Less than $1000	55	50	60	32	20	43
$1000 to $5000	24	33	30	53	57	39
More than $5000	21	17	10	15	23	18

four age categories, with 24% below 34 years of age, 24% between 35 and 44, 28% between 45 and 54, and 24% over age 55. This relatively uniform age distribution was reflected in each of the individual states, with no significant variation. Georgia applicators tended to be older than the norm, with only 18% under 34 and 33% over 55. New York's applicators were somewhat younger than the norm, with 28% in the 34 and under category and only 20% aged 55 or older.

Education Level - Exhibit 4.1-1 suggests that the applicators interviewed were fairly well educated, with 80% having at least graduated from high school and 36% having had some form of post-high school education. New York growers were the best educated of the sample, with 87% having completed high school and 45% having had post-high school education. Georgia growers had proportionately the least formal education, with 32% having less than a high school diploma. The educational attainment figures for both Nebraska and Iowa were nearly identical, with 84% and 86% having at least graduated from high school in both states.

Farm Size - Some 72% of all respondents operated farms of more than 100 acres, with nearly half of the sample (48%) falling within the 101- to 500-acre range. The farms in the Eastern states were, not surprisingly, much smaller than those in Midwestern states as can be seen in Exhibit 4.1-1. Only 5% of the applicators interviewed in both Nebraska and Iowa reported farm sizes of 100 acres of less. When farm sizes of 501 acres or more are considered, the sample ranged from nearly half the farmers in the Nebraska sample (46%) to a scant 7% of the respondents in Pennsylvania. Overall, however, a fairly balanced distribution of farm size was obtained; about half in the 101- to 500-acre range and approximately a quarter of the sample falling in each of the lower range and upper range farm size categories.

Years of Pesticide Experience - Exhibit 4.1-1 next illustrates the distribution of study respondents with respect to years of pesticide experience. Overall, those interviewed in the survey were highly experienced in pesticide usage. About 69% of all respondents reported having 11 years or more of experience using pesticides, and over a third of the sample reported having 21 years or more. About a third of the sample reported having 10 years or less of experience with pesticides. This level of experience was comparable in each of the five states.

Frequency of Application - How often growers applied pesticides to their fields in the last three years varies widely from state to state, again shown in Exhibit 4.1-1. For the total sample, those who applied pesticides more than five times per year account for one-third of the respondents. Approximately a quarter of the respondents apply once a year or less, and 6% reported not having applied pesticides in the last three years. Applicators from New York and Georgia reported the highest frequency of pesticide use and Iowa and Nebraska the lowest. These differences are no doubt driven by the regional differences observed above and below sections with regard to farm size, principal crops, and principal pests.

Pesticide Expenditures - The sample was nearly evenly divided between those who spent $1000 or more last year (1980) for pesticides (57%), and those who spent less (43%). As might be expected, in the states where farms are largest, the pesticide expenditures are the greatest. For example, 80% of the Iowa respondents reported spending $1000 or more last year on pesticides, while only 40% of the Pennsylvania respondents spent as much. Only 10% of the Pennsylvania growers spent more than $5000 last year. The growers in the other two eastern states, Georgia and New York, tended also to report spending less last year than either Iowa or Nebraska. Exhibit 4.1-2 illustrates in three dimensional form the strong positive association ($r = .55$) between farm size and annual pesticide expenditures for the five state sample.

Principal Crops - Exhibit 4.1-2 A and B displays the primary principal crop (mentioned first) and the secondary principal crop (mentioned second) for each state sample and the total sample. When asked to name their principal crops, 55% of all growers specified corn, and this was true of 92% of the Iowa respondents. Fruit was the next most often identified principal crop among the respondents, with a modest 8% reporting fruit as a principal crop. A significant percentage of respondents in

ANNUAL PESTICIDE EXPENDITURES BY SIZE OF FARM
AMONG PRIVATE PESTICIDE APPLICATOR
SURVEY RESPONDENTS (N=2000)

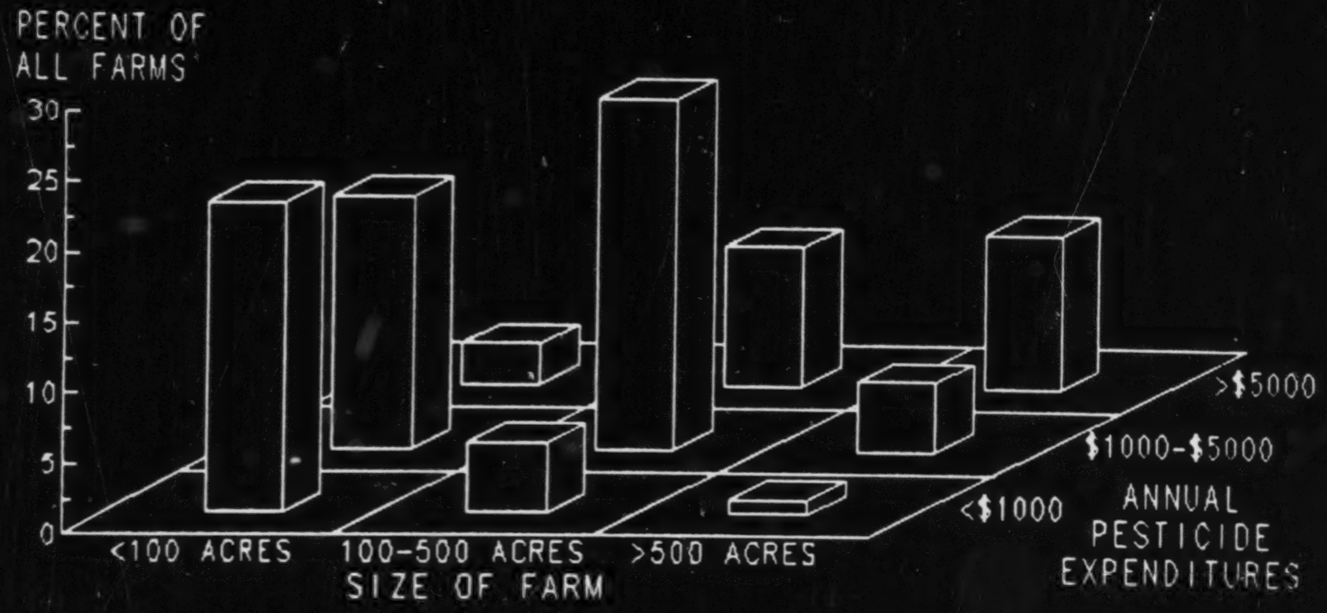


Exhibit 4.1-2 A

Principal Crops

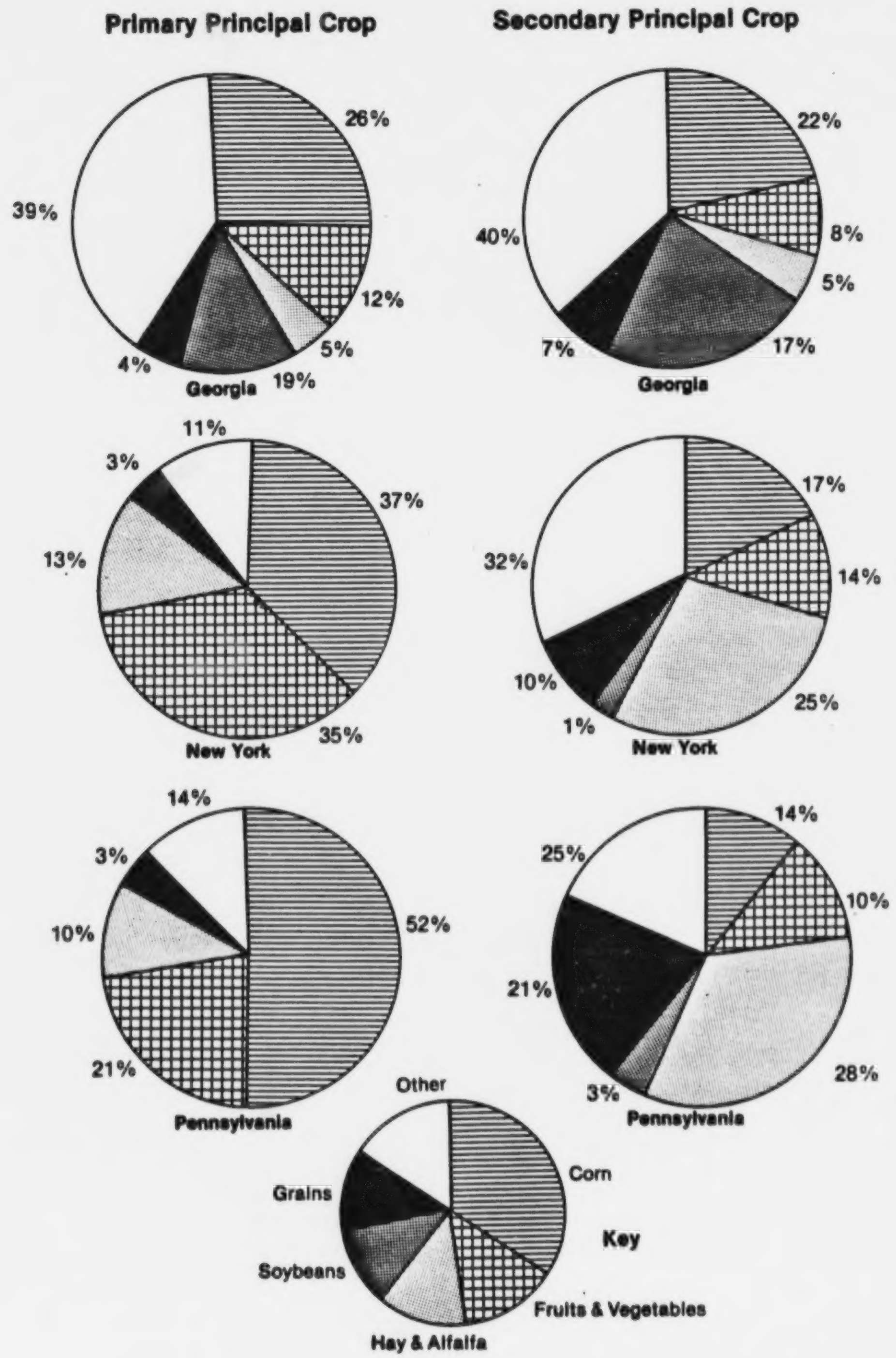
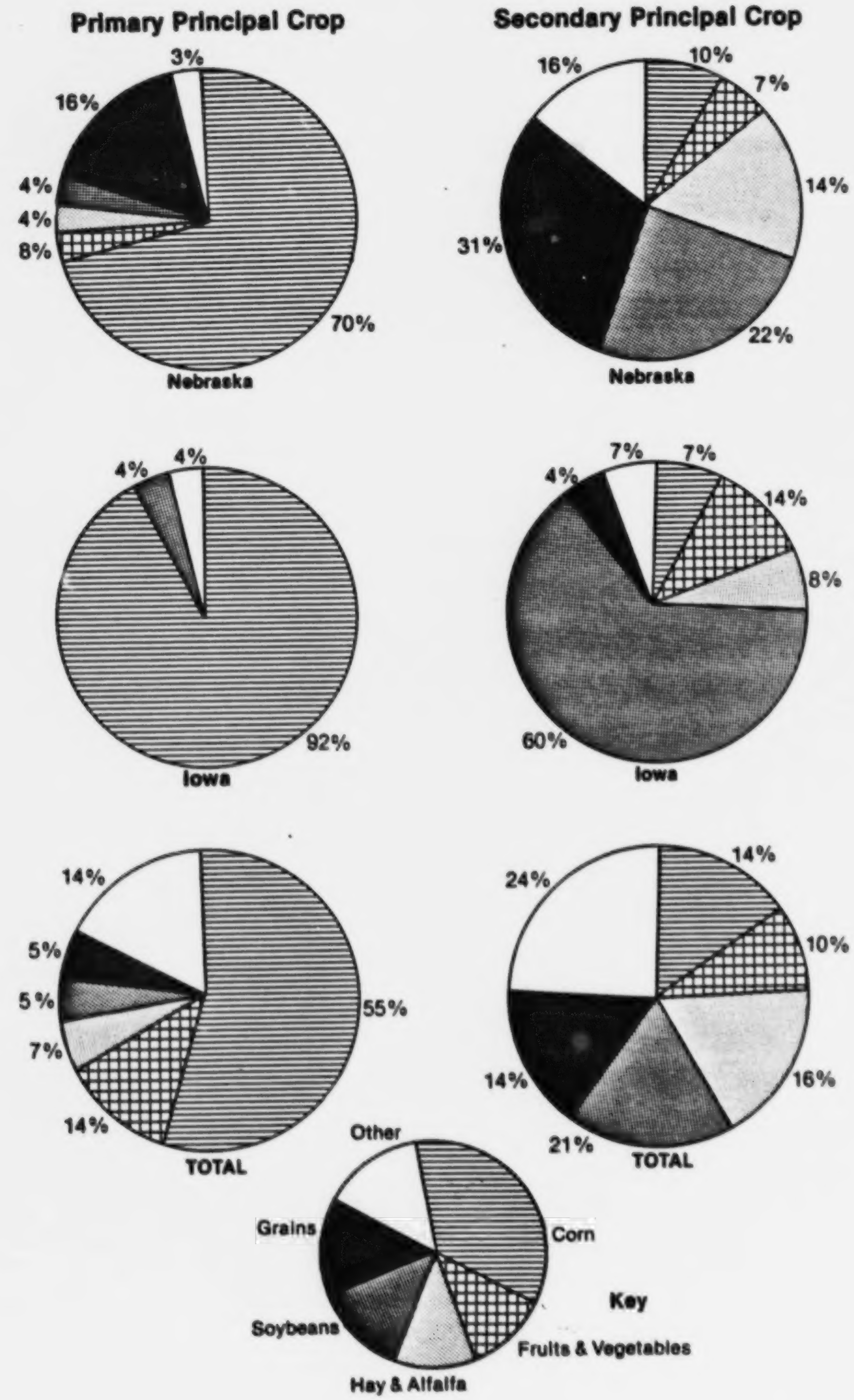


Exhibit 4.2-1 B

Principal Crops
(Continued)



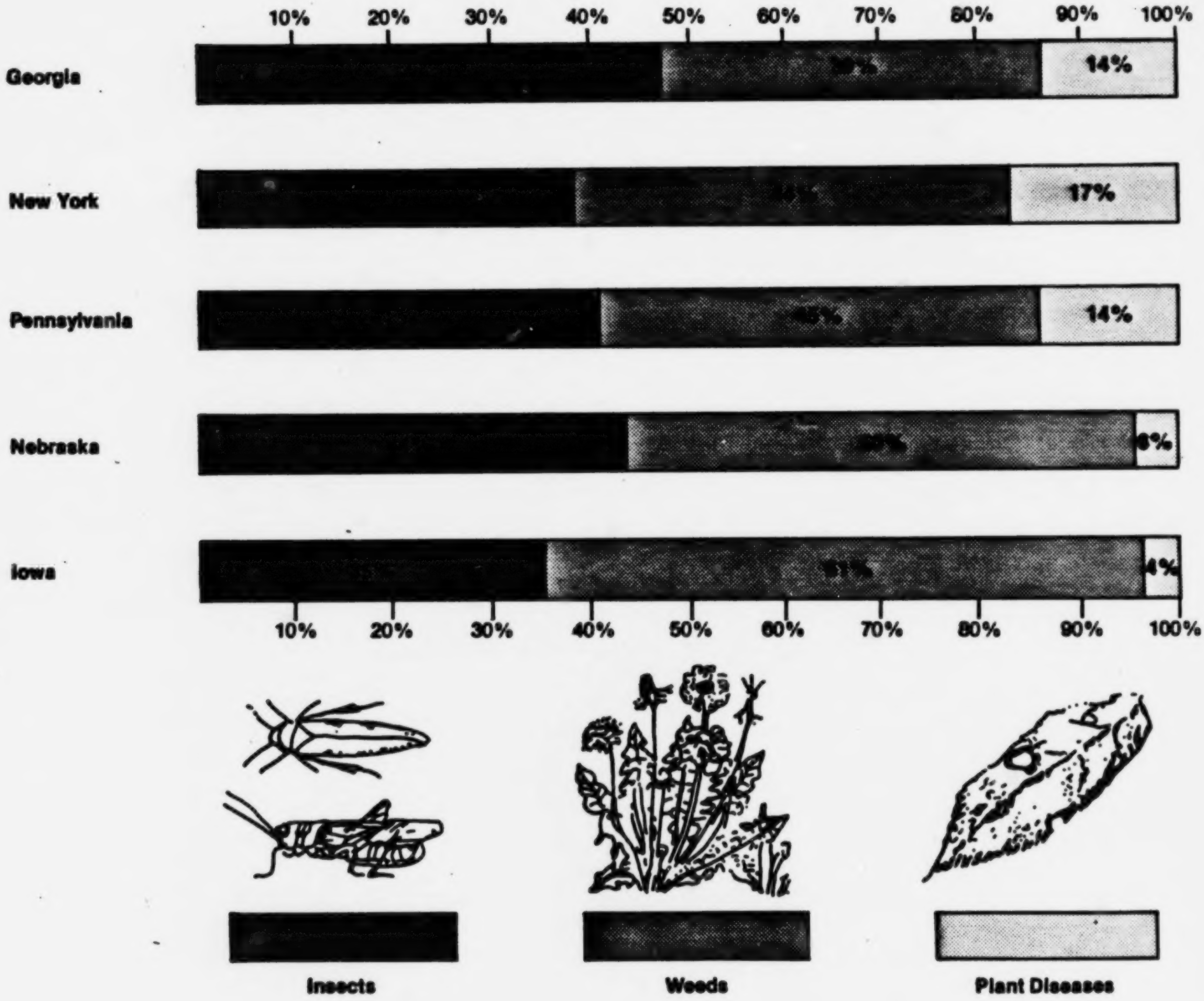
Georgia reported crops like tobacco, peanuts, and cotton, which were virtually nonexistent as primary crops in the other study states. It should be noted that this reflects only the relative frequency with which respondents reported these crops as principal crops, not the proportionate amount of acreage devoted to these crops among the sample states. Among secondary crops, soybeans were most common overall (and in Iowa and Nebraska), while hay and alfalfa were most common in Pennsylvania, and corn most common in Georgia.

Principal Pests - The principal pests for which pesticides are used by study respondents are displayed in Exhibit 4.1-3 as a percentage of responses rather than of respondents, since many growers cited both insects and weeds, for example, as their principal pest problems. When asked to identify the principal pests for which they applied pesticides, weeds constituted 48% of all responses followed closely by 41% which identified insects as the primary pest. Only 11% of the growers' responses included plant disease as a main problem requiring pesticide application. This general pattern varied across the five states. Among Georgia growers, insects were the most frequent problem for which pesticides were applied, constituting 47% of the responses, followed by 39% which specified weeds. By contrast, weeds are clearly the dominant pest problem in Iowa, with 61% of responses including weeds as a principal pest. Plant diseases ranked third in each of the five states and were identified most significantly in New York (17% of the responses given).

In sum, the background characteristics of study respondents provide a good range of age, education, agricultural and pesticide usage characteristics across the five states. No single characteristic appears to be overly represented, and the unique differences between the western and eastern states affords an opportunity to examine the potential for differential training impacts on pesticide practices caused by variations in climate and crops. In the next section, the training characteristics of the state private applicator training and certification programs as reported by the sample of previously certified growers are examined.

Exhibit 4.1-3

Principal Pest (Expressed as a Percentage of Responses)



4.2 Analysis of Training Program Characteristics

In order to determine the various types of training methods which the growers were exposed to during training--and to assess the relative and perceived value of these various methods to the grower--a series of questions were asked regarding six different training methods. These training methods represent the range of training methods used in each of the five states in the study. The methods include:

- a slide/tape series (typically the Colorado Slide/Tape Series or some modest adaptation);
- film or videotape presentations;
- demonstrations:
- lectures;
- a training manual (commonly the EPA Core Manual, the Northeast Core Manual, or some modest adaptation); and
- workbooks.

For each grower indicating that one of these methods was used in either a group training session or in self-study training, the grower was asked whether or not the methods were: "very useful," "somewhat useful," or "not very useful." The grower was also asked to provide an overall assessment of the training and certification program, to indicate the perceived advantages and disadvantages of the program, and to assess the overall value of the certification process and (for those already recertified) the recertification program.

In the following sections the growers' perceived sense of worth of the overall training and certification program is presented, along with an analysis of the growers' assessment of individual training elements used in training. Although a broad overview of the characteristics of the training and certification programs in the states is provided in the following section, more detailed individual state program descriptions can be found in Section 3.0, Training Program Profiles.

4.2.1 Program Description and Overall Assessment

An analysis of the growers' overall assessment of the private applicator training and certification program requires a careful consideration of the type of training each grower received in each of the five states in the study as well as an understanding of the considerable variation in training methods which the five states represent. Exhibit 4.2-1 summarizes some of the key characteristics of the training programs in each of the five states. As detailed in Chapter 3, the five states in the sample represent a broad range of training experiences and differences in terms of program emphases and phases of program development.

The analysis of training program characteristics must also be sensitive to the fact that respondents are reporting upon their perceptions of the value of training perceived at the time they participated in the program, and the current training programs may be programmatically different. All five states, for example, began their training and certification programs with hundreds of group training sessions held locally by county agents at scheduled intervals; today, group sessions for initial certification tend to be infrequent in each of the states and scheduled on an "as needed" basis. The county agents frequently conduct individualized training rather than group training, and as this general trend away from group sessions takes place, new materials and methods are being implemented to make individualized training more practical (such as Georgia's self-study video tape machine).

As experience with the training programs in the states accumulates, variations not only in methods but in subject matter emphases have also developed. Obviously, many of the programmatic changes were brought about as a result of the changes in the types of pesticides available to the growers and whether or not the pesticides which the growers wanted to use were restricted by either the federal or state government. The content of the training programs clearly reflects the types of principal crops grown in each state and the most common pest, and pesticides, used by the growers. Finally, changes in certification requirements have occurred in some states since the time that many of the survey respondents were trained. For example, Iowa initially required an examination as part of the certification process; currently only Pennsylvania and New York among the five study states require examinations.

Exhibit 4.2-1

Key Training Characteristics

STATE	TRAINING REQUIRED	EXAM REQUIRED	FEE REQUIRED	KEY FORMAT AND TRAINING CHARACTERISTICS	TOPICS EMPHASIZED	HOME STUDY/ SELF-STUDY OPTION
Georgia	Yes	No	None	● Colorado Slide/Tape Series Adapted to Self-Use Machine ● "Understanding Labels" Non-scored Questionnaire	● Labeling ● Calibration	Yes (But Rarely Used)
Iowa	Yes	No	$5	● EPA Manual (Iowa supplies) ● Lecture with Calibration and Label Exercises ● Colorado Slide/Tape Series ● Demonstration on Calibration and Pest Identification	● Safety in Handling ● Mixing and Application	Exam without Training Option Rarely Used
Nebraska	Yes	No	None	● Colorado Slide/Tape Series ● EPA Core Manual and Lecture ● Supplemental Workbook ● Calibration Exercises	● Calibration ● Storage ● Disposal	Yes, Self-Study and Exam, but Rarely Used
Pennsylvania	No	Yes	None	● Self-Study from Pennsylvania Core Manual with Self-Admin. Exam ● Sessions Using Colorado Slide/Tapes/Lectures with Open-book Exam	● Labels ● Safety in Use and Handling ● Calibration	Yes (Est. 95%)
New York	No (Self-Study Option Exists)	Yes	$15	● Northeast Core Manual ● Film on Pesticide Safety ● Northeastern Core Slide Series with Trial Exam and Discussion ● Self-Study/Home Study Option Based on Northeast Core Manual	● Labels ● Envir. Hazards ● Safety in Use, Storage and Disposal ● Drift Control	Yes (Est. 15%)

As Exhibit 4.2-2 illustrates, the majority of respondents reported receiving their training through a classroom-type session, while only 16% said they were trained through an individual self-study course. Self-study was a prominent training mode in Pennsylvania, with 57% of the respondents identifying it as their training method. Pennsylvania and New York are the only states in the study which formally offer the option of self-study or classroom training, and where the option is readily exercised in the other three states only up to 4% were trained by self-study). In Georgia, Iowa, and Nebraska the small percentages of growers reported being trained by self-study represent those who either opted to take an examination in lieu of training (in Iowa, for example), studied from a self-study manual and took an exam (as in Nebraska), or completed individual instruction requirements under supervision of their county agents (as in Georgia).

The growers were asked to evaluate how worthwhile they found the state training program to be (exclusive of certification requirements or fees). Some 47% of all applicators found the training "very worthwhile" and an additional 40% regarded their training as "somewhat worthwhile". Only 13% rated the training as "not very worthwhile". As Exhibit 4.2-3 reveals, the Georgia applicators were the most favorable towards training, with 61% feeling it was very worthwhile. By contrast, only 35% of the Iowa growers rated the training as very worthwhile. Following Georgia, the New York program received the next highest rating with every other respondent rating the training as very worthwhile. Pennsylvania and Nebraska closely followed New York with 46% and 45% of their applicators respectively rating their training as very worthwhile.

Iowa and Nebraska growers indicated the least favorable perceptions about the value of the training program. In part, these feelings undoubtedly reflect whether or not the growers believe the training gave them information of value, either in terms of agricultural practices or in terms of personal or environmental safety when handling pesticides. In Iowa, for example, since growers predominantly use pesticides which are not restricted, the training requirement is rated as having less

Exhibit 4.2-2
Training Type

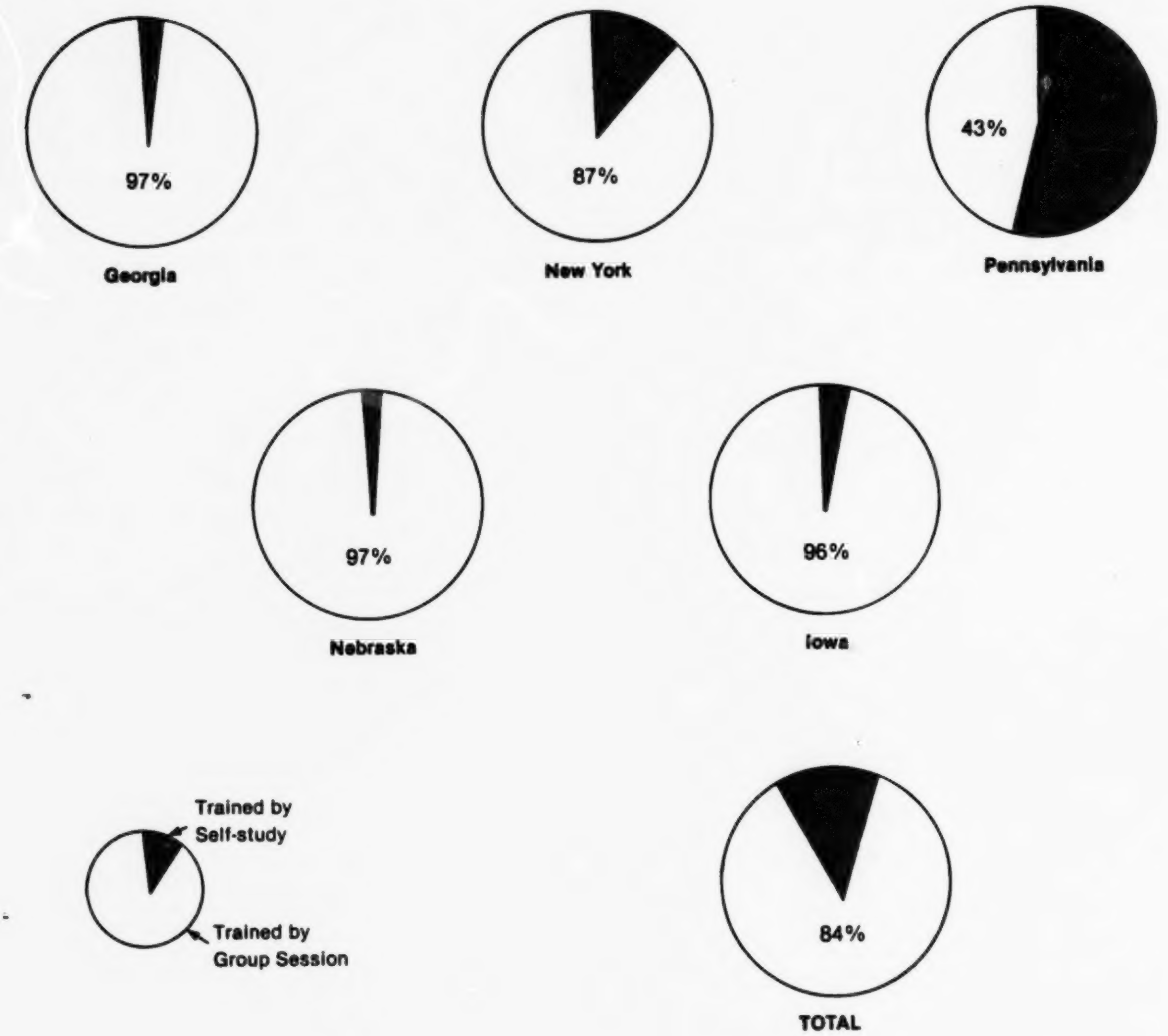
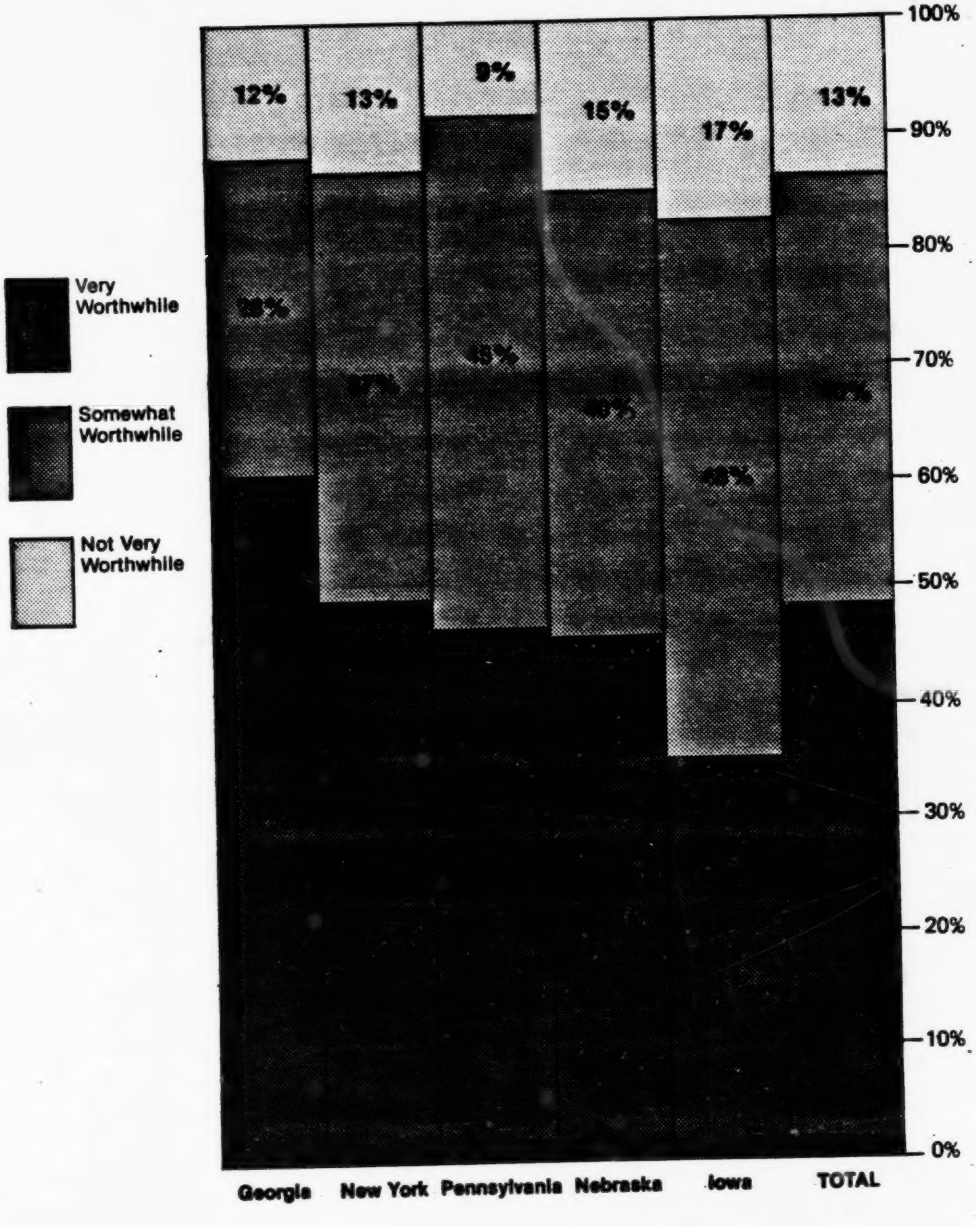


Exhibit 4.2-3
Perceived Value of Training



value (measured by 17% who found the training "not very worthwhile") when compared to ratings by growers in Georgia and New York; New York having a more extensive list of restricted pesticides than any other state in the study. In Nebraska, the bitter political battle and "antigovernment" publicity may further account for some grower animus toward the program.

4.2.2 Advantages and Disadvantages of the Program

To help explain the growers' overall rating of the worth of the training program, the respondents were asked to indicate the advantages, and then the disadvantages, of the state private applicator training and certification program. It is important to note that the respondents provided open-ended voluntary responses which were later postcoded into frequent categories of response. No response cues were provided.

Exhibit 4.2-4 specifies three major categories of perceived advantages of the program, clustering them roughly into (1) advantages associated with the handling of pesticides; (2) advantages relating to personal safety and safety awareness; and (3) advantages associated with the safety of the environment. Two out of every three respondents indicated that a major advantage of the program was that it teaches proper use, how to prevent misuse, and limits use of pesticides to qualified people only. In Georgia, Pennsylvania and New York significantly higher percentages of respondents felt the training program was particularly advantageous for purposes of teaching and enforcing proper pesticide use and handling practices. The smaller percentage (57%) of Iowa growers who reported advantages of this nature may be attributable to the fact that the Iowa grower uses nonrestricted pesticides and that the handling of there pesticides which are used is not perceived to warrant training.

With respect to advantages relating to personal safety and safety awareness, around 60% of the respondents overall, and in each of the five states, found safety to be a particular program advantage. This was true even for Iowa growers, where the need for safety precautions in the handling of pesticides probably extends to the use of nonrestricted pesticides and the dangers associated with substances typically believed to be less toxic.

Exhibit 4.2-4

Perceived Advantages of the Program

	GEORGIA (%)	IOWA (%)	NEBRASKA (%)	PENN. (%)	NEW YORK (%)	TOTAL (%)
1. Teaches proper use, how to prevent misuse, and limits use to qualified users only.	76	57	63	74	72	68
2. Creates awareness of the dangers and the need for safety precautions.	59	60	61	59	66	61
3. Helps to protect crops, livestock, wildlife, and the environment.	18	8	8	12	16	13

Relative to other advantages, only 13% of the respondents cited advantages associated with the safety and protection of the environment, crops, and livestock. These percentages may be slightly higher in Georgia and New York than in Iowa and Nebraska because of the emphasis in Georgia and New York on outdoor recreation (hunting and fishing) among the farmers and New York's concerted effort to emphasize the environmental safety aspects during training. In general, the growers cited personal safety information as a more advantageous aspect of the training than environmental protection.

Exhibit 4.2-5 specifies four categories of disadvantages frequently cited by the growers, including (1) no disadvantages; (2) disadvantages associated with inconvenience and perceived lack of importance; (3) disadvantages resulting from perceived interference on the part of the federal and/or state government and associated cost to the government or to the grower directly; and (4) disadvantages associated with the perception that the training was irrelevant and of little value to the grower. About half of the respondents felt that there were no disadvantages to the training and certification program, although the percentages were slightly less in Iowa and significantly less in New York. Three out of four growers in Georgia indicated that the program had no disadvantages from their perspective, a measure of perceived value which far exceeds the average for all five states. Concurrently, only 8% of the Georgia growers felt disadvantages associated with inconvenience, only 7% expressed disadvantages associated with expense or interference, and only 3% felt the program was too simple or irrelevant to be of any advantage to them.

Across all four major categories, Georgia growers consistently failed to express negative reactions in areas which growers in other states indicated as particular disadvantages. In general, both Iowa's and New York's growers were relatively more expressive of disadvantages with their programs than were growers in the other states. In the case of Iowa, this may reflect general dissatisfaction with a training and certification program in a state with few, if any, restricted pesticides

Exhibit 4.2-5

Perceived Disadvantages of the Program

	GEORGIA (%)	IOWA (%)	NEBRASKA (%)	PENN. (%)	NEW YORK (%)	TOTAL (%)
1. No perceived disadvantages.	75	50	58	58	46	58
2. Perceived as an inconvenience, unimportant, and a waste of time.	8	22	24	17	28	20
3. Considered too expensive and involving too much government interference.	7	18	10	8	16	12
4. Considered too simple, irrelevant to the job, and not teaching anything new.	3	5	5	5	8	5

being used by the growers. In New York, some dissatisfaction may be traced to the required participation in two separate training "sessions," the requirement of a supervised and scored closed book examination, and the fee associated with certification.

4.2.3 Assessment of Individual Training Elements

The respondents were asked whether or not their training included each of the following training elements: (1) slide/tape program; (2) film or videotape; (3) demonstration (training session only); (4) lecture (training session only); (5) manual; and/or (5) workbook. Each respondent who said training included a given element was asked immediately to indicate whether the element was "very useful," "somewhat useful," or "not very useful." Exhibits 4.2-6 through 4.2-11 illustrate the total percentage of respondents in each state who reported being trained with each element in a training session or by self-study, and how these respondents rated the usefulness of each element.

Manuals and workbooks. The use of a training manual was the most widely reported training element, with 90% of all respondents recalling having used one, as shown in Exhibit 4.2-6. Unlike the other states, the majority of respondents in Pennsylvania used the training manual in a self-study (correspondence) program. Of those who reported using a manual in each state, the percentage who found it to be "very useful" was also higher for any other training element, ranging from 69% in New York to 43% in Iowa, with an average of 56% for all five states.

Exhibit 4.2-7 displays the percentage of respondents who said they used a workbook as part of the training and also displays their perceived usefulness of the workbook. Overall, three-fourths of the growers reported using a workbook, ranging from 59% in Georgia to 87% in Nebraska. Since Iowa, Pennsylvania, and New York do not have workbooks as part of their training materials, the private applicators in these two states no doubt confused the term with either the training manual itself or some other handout material. The workbook in Georgia is primarily a labeling exercise, and this received the highest percentage (54%) of users who found it "very useful." In both manuals and workbooks, the percentages of growers who found them to be "not very useful" are very small.

Exhibit 4.2-6
Training Element Usage and Usefulness: Manual

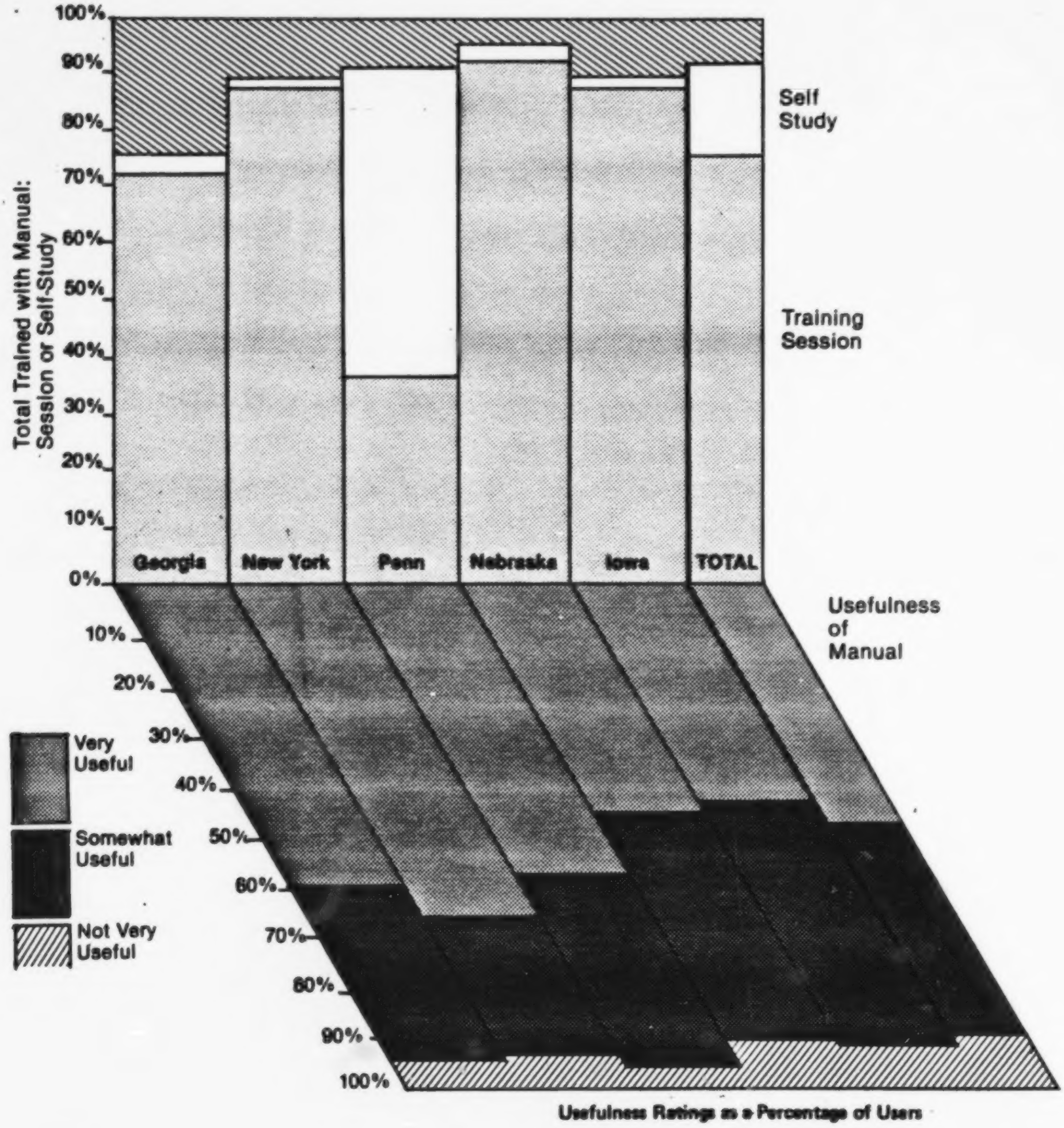
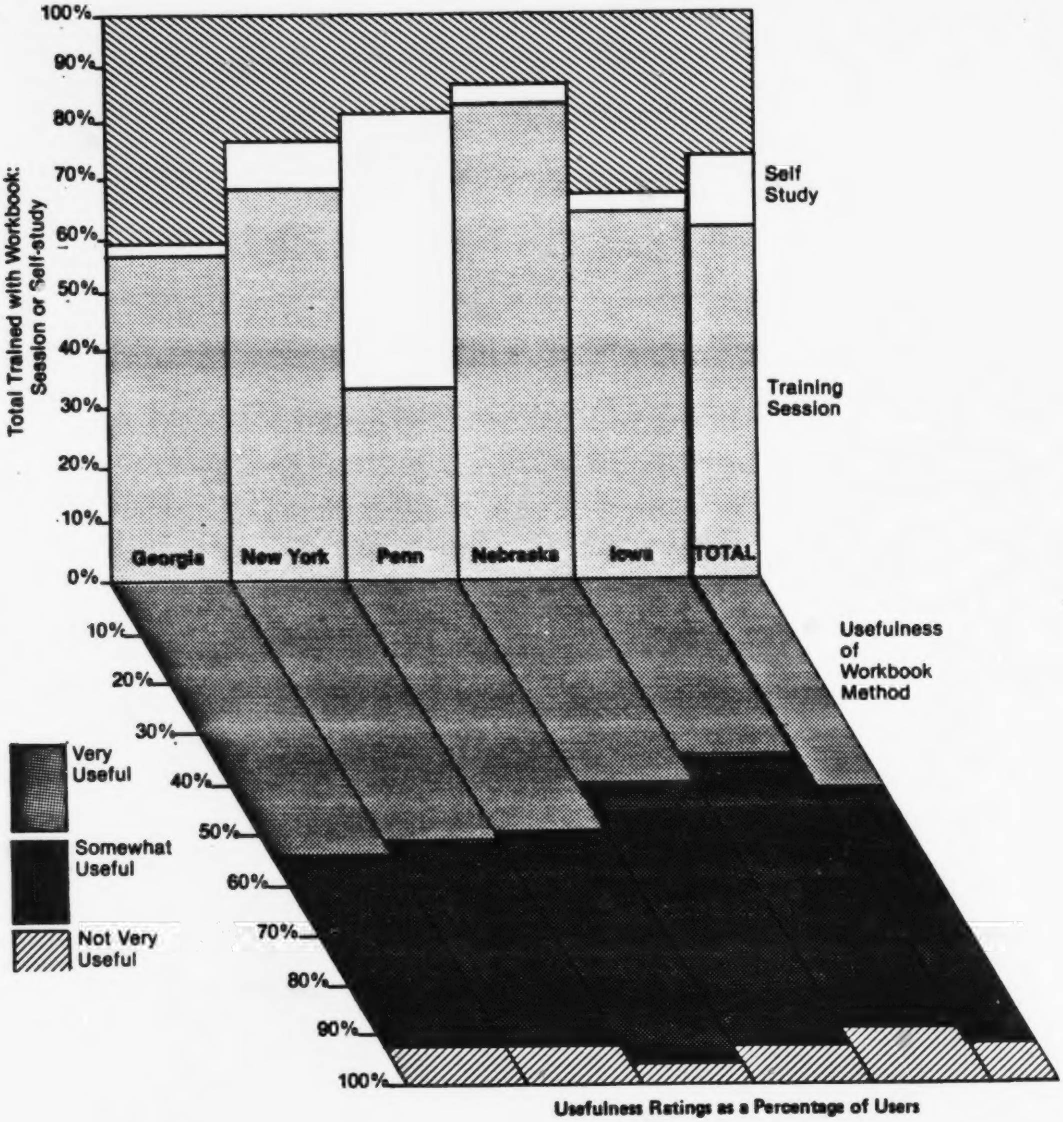


Exhibit 4.2-7
Training Element Usage and Usefulness: Workbook



Slide/Tape Series and Films. As seen in Exhibit 4.2-8, the slide/tape series was reportedly viewed by much higher percentages of growers in Georgia (90%), Nebraska (95%) and Iowa (86%) than in New York (64%) or Pennsylvania (31%). The usefulness ratings are also highest in Georgia (62% "very useful) and lowest in Pennsylvania (35% "very useful"), with the total sample of users split evenly between rating it "very useful" (47%) and "somewhat useful" (47%).

As was the case with the workbook, Exhibit 4.2-9 seems to indicate some confusion on the part of the growers in several of the states when asked whether or not they had been shown a film during training. Films were only shown to growers in New York, yet a majority of respondents in each state reported seeing film--most likely confusing the slide/tape series with the term "film." Slightly over half of those in New York who recalled the film found it to be "very useful " while 10% who felt it was "not very useful." (The New York film deals with the subject of personal pesticide safety.)

Demonstrations. Only 31% of all respondents said that their training included some kind of demonstration (such as proper equipment calibration or pest identification techniques), ranging from 42% of the Georgia respondents to a low of 19% of the Pennsylvania respondents (see Exhibit 4.2-10). Those who did see a demonstration, however, rated it very favorably, especially in Pennsylvania and Georgia, where over 60% of those who recalled this training element found it to be "very useful."

Lectures. Finally, in all states surveyed except Pennsylvania, a very high percentage of respondents received a lecture as part of their training as shown in Exhibit 4.2-11. Because of the large self-study group in Pennsylvania, only 41% of the private applicators in this state cited a lecture as part of their initial training. Reflecting a pattern common to many of the training elements, the ratings of the usefulness of the lecture were very favorable in Georgia (60% "very useful"), favorable in New York and Pennsylvania (about 50% "very useful") and less favorable in Nebraska and Iowa (about 40% "very useful").

Exhibit 4.2-8
Training Element Usage and Usefulness: Slide/Tape Series

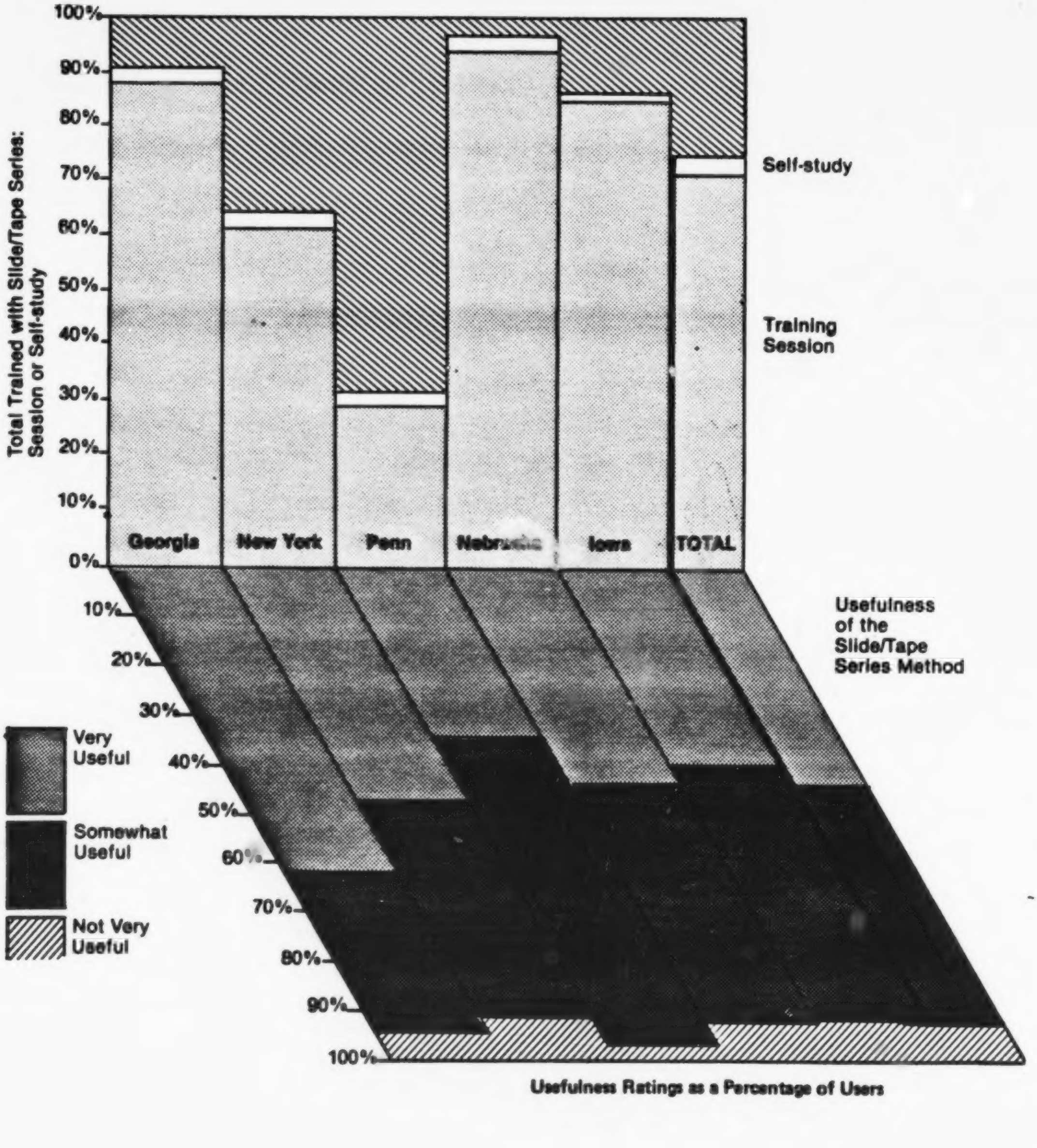


Exhibit 4.2-9
Training Element Usage and Usefulness: Film

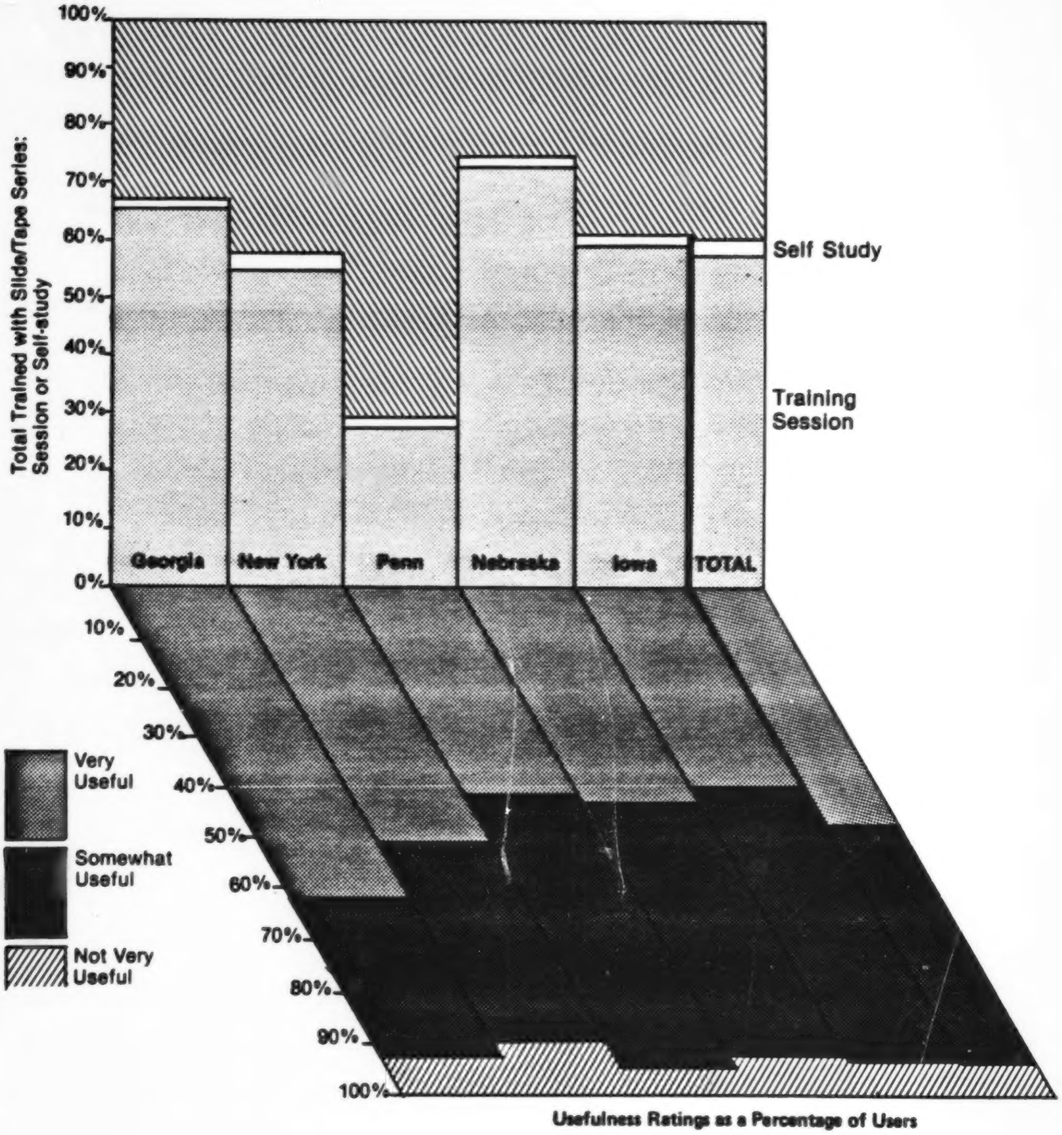


Exhibit 4.2-10
Training Element Usage and Usefulness: Demonstration

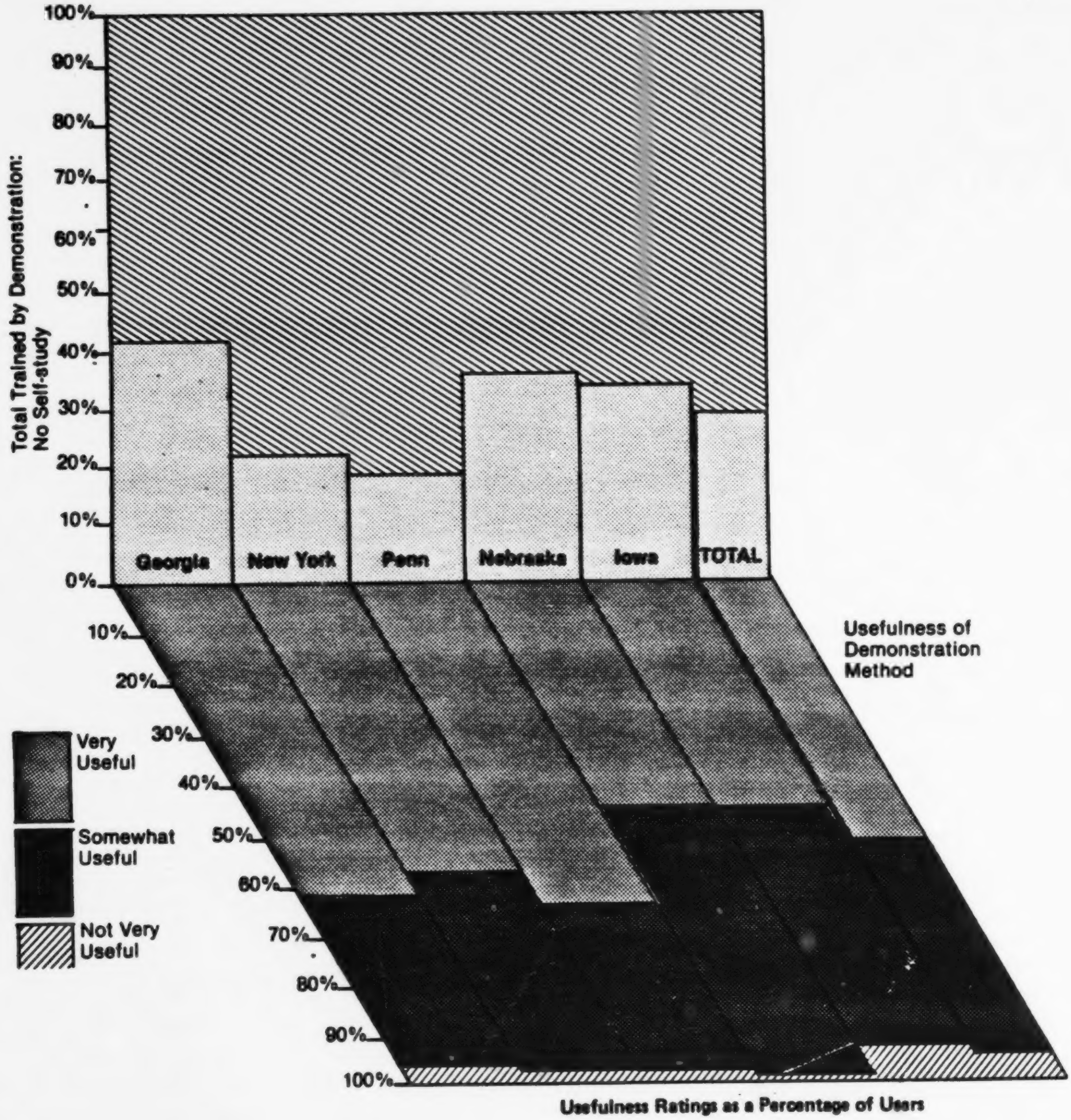
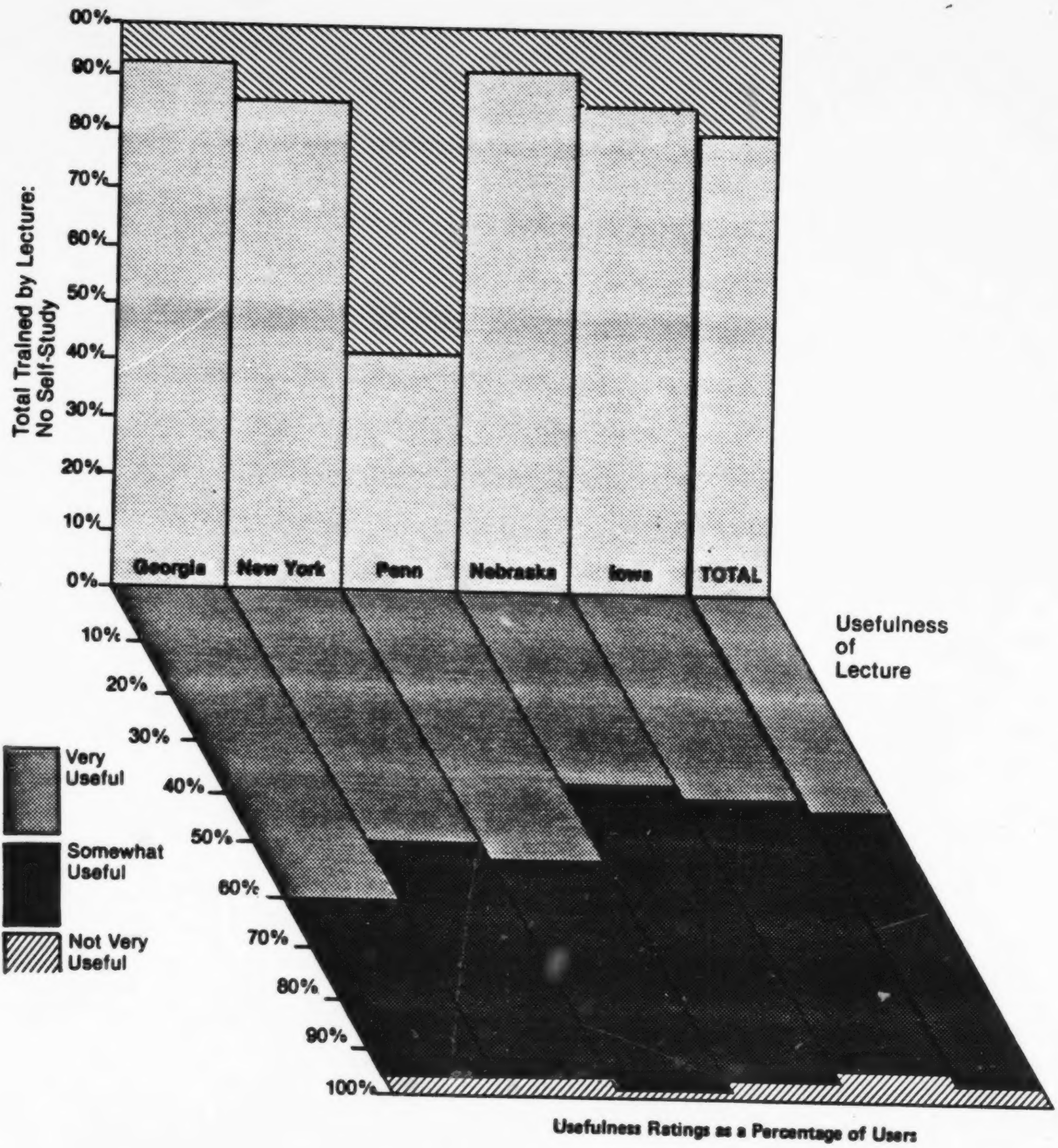


Exhibit 4.2-11
Training Element Usage and Usefulness: Lecture



4.2.4 Initial Certification and Recertification[1]

The table below provides information concerning the year when the respondents in each of the states was certified. (In most states, there was a lag of at least several months between training and initial certification, so dates for training and certification do not necessarily correspond. For the total sample, about 70% of the growers reported being certified in either 1977 or 1978. In each of the states a similar pattern is found with a majority of applicators reported being certified in those two years, ranging from a high of 76% in Nebraska who were certified in those two years to a low of 60% in New York. Nearly all of the respondents (86% for the entire sample) reported being certified by 1979, including 89% for Georgia and 83% for Pennsylvania, the high and low states.

Year of Initial Certification (%)	GA	NY	PENN.	NEB.	IOWA	Total
1975	9	9	4	1	8	6
1976	8	15	10	5	18	11
1977	46	25	32	28	29	32
1978	27	35	37	48	37	38
1979	10	14	15	14	8	12
1980	1	2	2	4	0	2

Exhibit 4.2-12 illustrates and compares respondent attitudes concerning the importance of certification across the states. Overall, only 17% of all respondents felt that certification was not very important, with 49% regarding it as very important and an additional 34% viewing it as somewhat important. Certification was overall rated as most important in Georgia where 65% of the growers rated it as very important and only 14% rated it as not very important. By contrast, it was considered

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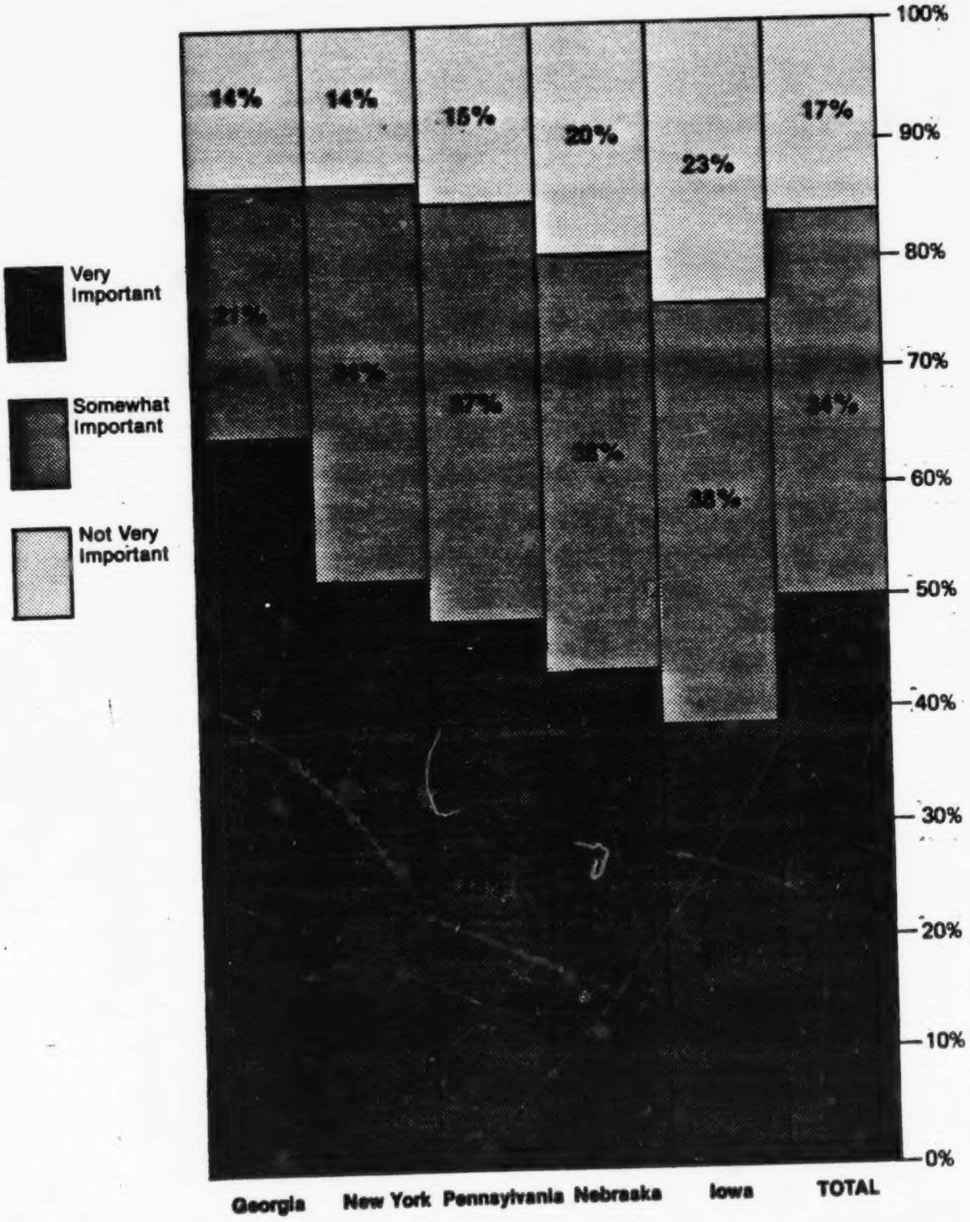
[1] These data reflect the grower-respondents' reported year of certification and recertification. As will become apparent, the data do not reflect accurately the activities in the states. For example, New York only "renews" the initial certification and will not begin "recertificaton" until 1984. However, the data should prove useful to the states in indicating the grower's apparent confusion about when original certification was issued and (more importantly) when recertification is due.

Exhibit 4.2-12
Perceived Importance of Certification

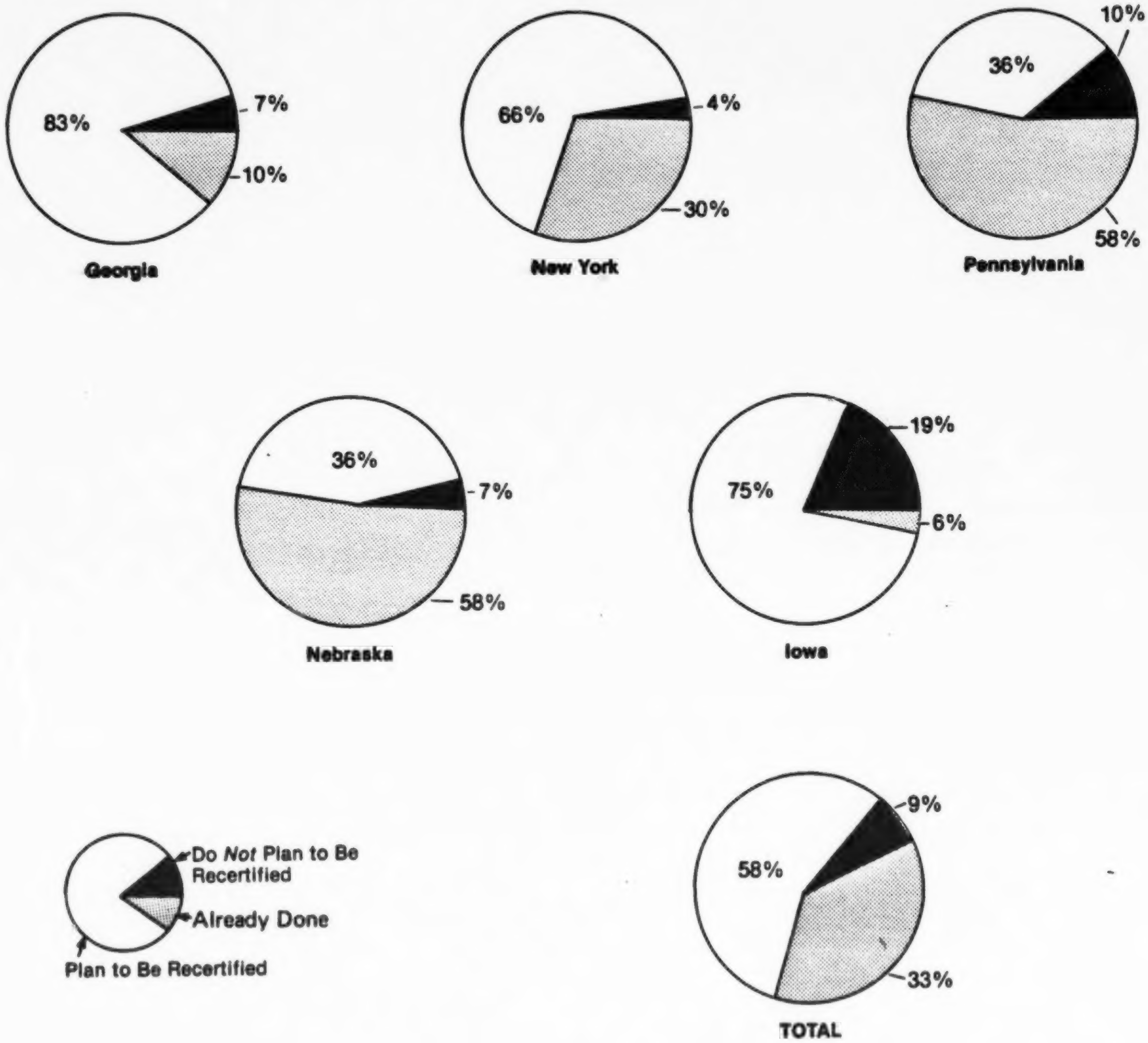


relatively less important in Iowa, where only 39% perceived it as very important and 23% perceived it as not very important. It may be this negativism in Iowa concerning the importance of certification which is behind the less favorable attitudes toward training itself among private applicators in this state.

Turning to the issue of recertification, nearly all of the respondents in each of the five states reported either have already been recertified or plan to be recertified. For all respondents, 58% plan to be recertified, 33% reported already have been recertified, and only 9% do not plan to be recertified. Exhibit 4.2-13 reveals some interesting variation in recertification plans among the five states. Iowa is notably in the high percentage of growers who do not plan to be recertified, 19%, and in the low percentage of growers who are already recertified, 6%. These percentages for Iowa are not surprising, given the fact that the Iowa respondents were the least positive in their views on the usefulness of both the training program and the certification requirement. Pennsylvania and Nebraska lead the other states in the percentage of growers who reported have already been recertified, 58% for each. New York reports the lowest percentage of applicators who do not plan to be recertified, 4%. Georgia has the highest proportion of growers who plan to be recertified and have not already done so, 83%, as Exhibit 4.2-13 demonstrates.

Assessment of Recertification. The respondents who were already recertified were asked to evaluate how worthwhile they found the recertification program to be. In most states the recertification program was not received with enthusiasm. Only 32% of all respondents rated the program as very worthwhile, and nearly a majority, 49%, scored it as somewhat worthwhile. New York growers were the most critical of the program, with 29% regarding it as not very worthwhile and an additional 42% rating it as only somewhat worthwhile. However, it is important to note that these growers confused New York's "Renewal" procedure with the

Exhibit 4.2-13
Recertification Status and Plans

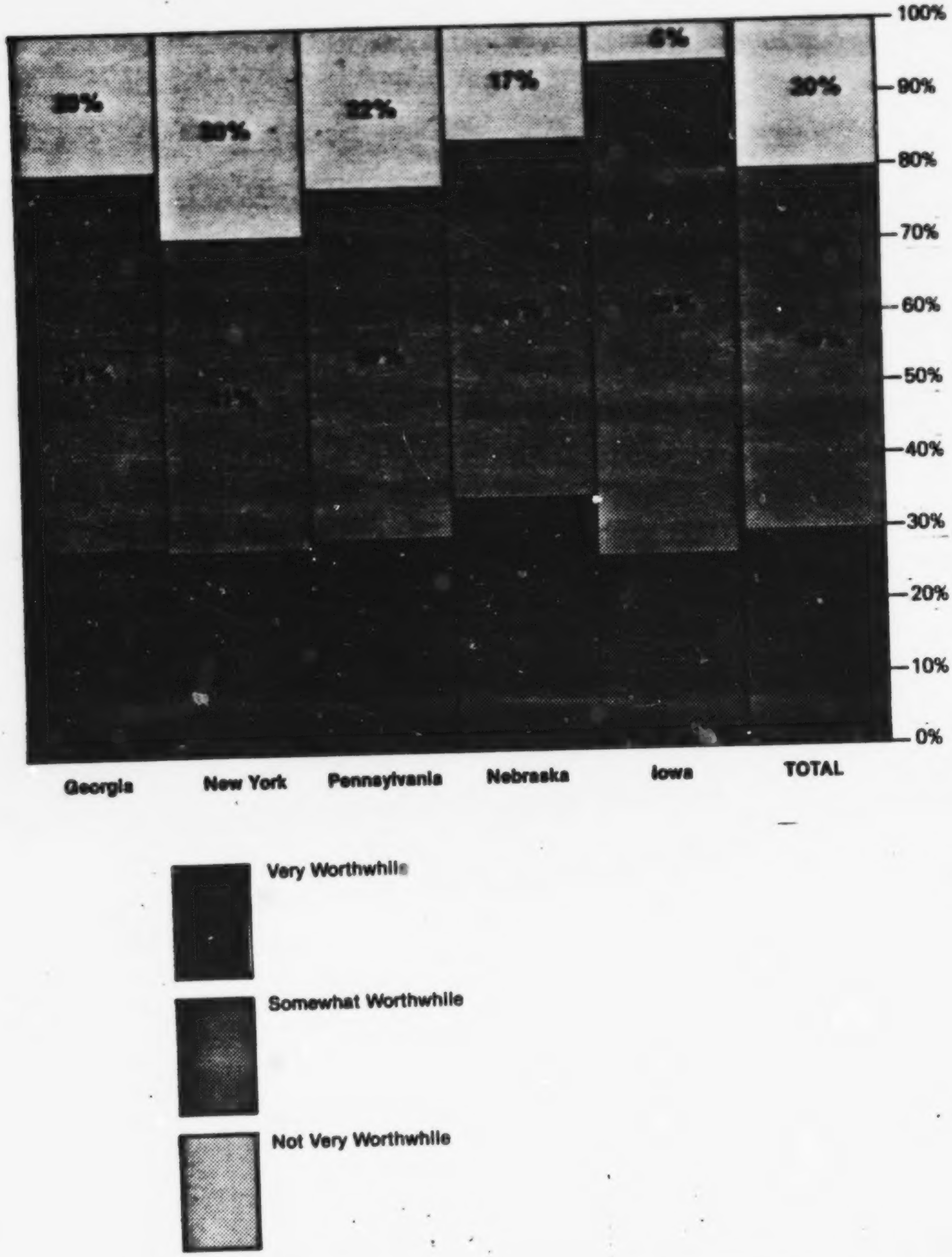


state's recertification program (see Appendix A). It is of particular interest that the Iowa growers, the group which tended to be most critical of the initial training program in its component parts, were among the most favorable concerning the recertification program. Iowa had the smallest percentage rating the recertification program as not very worthwhile, 5%, and the largest percentage viewing it as somewhat worthwhile, 68%. As Exhibit 4.2-14 illustates, Nebraska--a state critical of the initial training program--had the highest proportion of applicators who viewed the recertification program as very worthwhile, 35%. Since 58% of the Nebraska applicators had already been recertified, the relatively favorable ratings in Nebraska regarding recertification are especially noteworthy.

4.2.5 Source of Pesticide Assistance

There was substantial variation among the states in terms of the respondents' reported source of pesticide assistance. Respondents were asked, "If you are not sure about how to use a pesticide, or which pesticide to use, where are you most likely to go for assistance?" Exactly half of the full study sample said that they would most likely go to their county agent, 47% said that they would go to their chemical dealer, and only 3% specified some other source. As shown in Exhibit 4.2-15, three-quarters of the Georgia respondents said that they would go to their county agents, while in Iowa, 76% said that they would go to their chemical dealer. New York, Pennsylvania, and Nebraska were more evenly divided. The importance of the chemical dealer in Iowa and Nebraska is consistent with the observed strength of dealer associations in the Midwestern states. In the Eastern states of Georgia, New York, and Pennsylvania--where chemical dealer associations are comparatively weaker--the county agent appears to represent a more important source of information. A major reason for this regional difference is that in the Midwest, where there exists only one extensive agent per county, the ratio of agents to applicators is much lower than in the Southeast, where there typically exist five or six extension agents per county. This dramatic variation between states in terms of the primary source of

Exhibit 4.2-14
Perceived Worth of Recertification: Recertified Respondents Only



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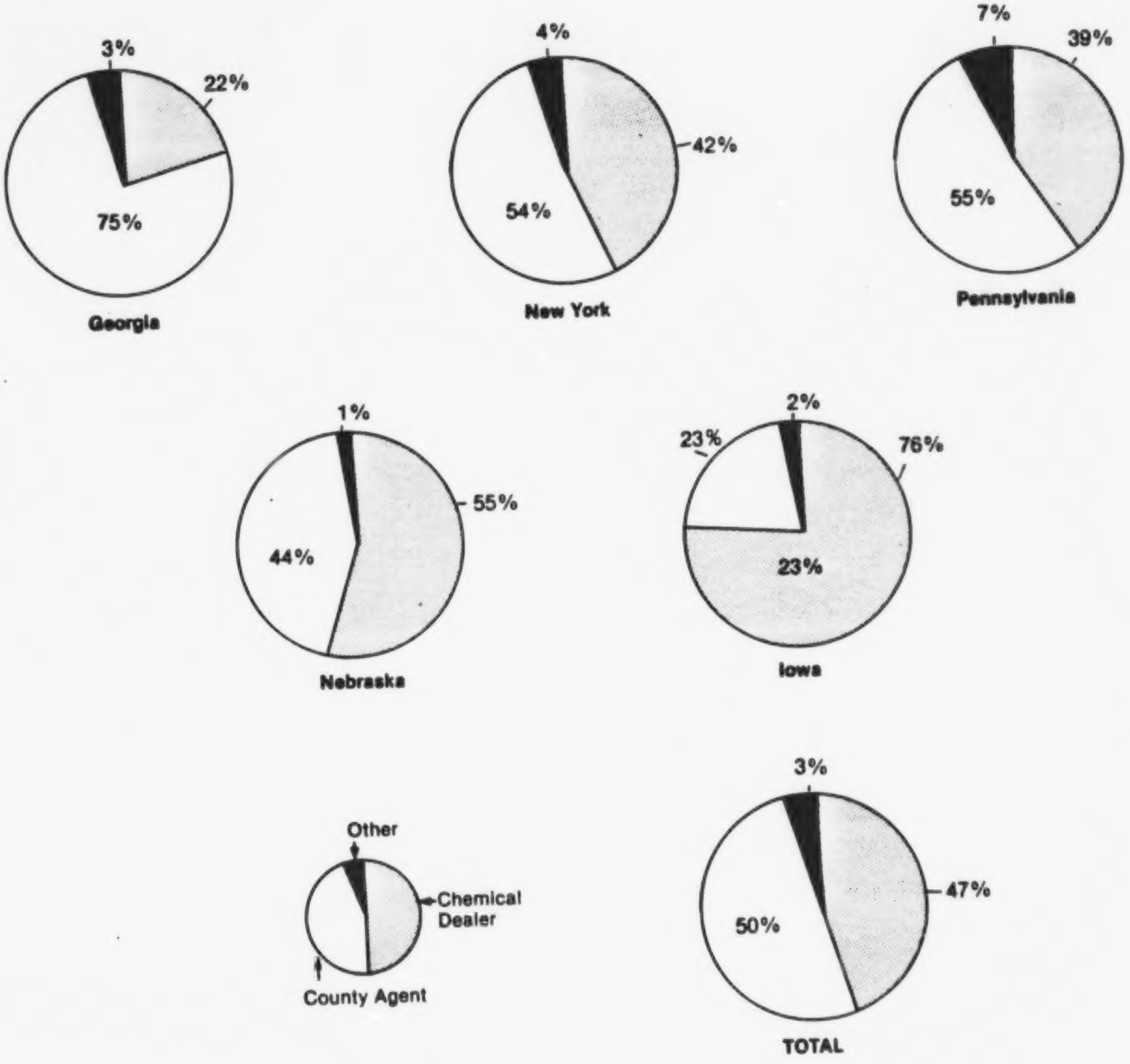
*Respondents in New York confused certification renewal with recertification, which is not scheduled to begin until 1984.

Exhibit 4.2-15
Source of Pesticide Assistance



information about the selection and use of pesticides takes on added importance for this study of the pesticide applicator training and certification program when one considers the potential role of the chemical dealer in disseminating information about pesticide use. Study findings show that respondents who reported being most likely to go to their county agents were also more significantly impacted in certain behavioral areas, specifically those behaviors having to do with personal safety. This correlation is more thoroughly assessed in Section 4.3.3.

4.2.6 Training Worth by Background Characteristics

In the analysis of the survey results, an effort was made to correlate respondent background characteristics with attitudes concerning the worth of the training. This analysis addresses questions as to whether there is a relationship between the number of acres farmed and attitudes concerning the worth of the training. If so, does it exist in each of the states? In correlating background characteristics with expressed attitudes concerning training worth, we defined statistical significance to be at the 95% confidence level.

The data show a number of interesting correlations as well as lack of correlations. We found that in all states but Nebraska and Pennsylvania, the fewer acres the respondent farmed the more positive was his attitude toward the worth of the training (r = -.14 overall).[1] This was particularly true for Georgia (r = -.18) as well as for Iowa (r = -.14) and for New York (r = -.11). A slight correlation was found in two states, and in the total sample, between educational attainment and perceived worth of the training. In Iowa and New York the less well educated growers rated the training more highly than did the better educated growers. The degree of correlation was as follows: Iowa, r = -.07; New York, r = -.07; and the total, r = -.05.

It is somewhat surprising that in three states and in the sample as a whole, older growers tended to find the training more worthwhile than did the younger growers. This was particularly so in Georgia (r = .12) and somewhat less so in Iowa (r = .10), New York (r = .09) and for all respondents (r = .08). This finding appears to contradict the commonly held view that older applicators tend to be most resistant to the training and certification process.

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[1] Respondents were reporting all land farmed by them (... do you farm...) whether or not the land is owned or rented.

Very little relationship was found between the years of experience which an applicator had in using pesticides and attitudes toward the training process. A slight correlation exists only in New York (r = -.08), where it was found that the more exprienced applicators tended to find the training less useful than did the less experienced applicators.

A negative correlation exists between a respondent's expenditures on pesticides in 1980 and his attitudes toward the worth of training. Generally, the less an applicator spent on pesticides the more valuable he found the training. This was true for all states but Nebraska and most apparent in Iowa (r = -.17) and slightly less so in Georgia (r = -.15), New York (r = -.14), the entire sample (r = -.13) and Pennsylvania (r = -.07).

Perhaps the most interesting lack of association among the training variables was that no significant differences in assessment of training worth were found in any of the states (and overall) between those respondents who were trained in group sessions and those trained via self-study.

Since the correlation between a grower's background characteristics and his assessment of training worth described above are all less than r = ± .20, we can generally state that private applicators of all types of background seem to be similarly favorable towards training, some types slightly more so than others.

4.3 Analysis of Behavioral Characteristics

For those respondents reporting some use of pesticides within the last three years to control insects, weeds, or plant diseases (94% of the growers surveyed), a series of questions was asked to determine the impacts of training as perceived by the growers on the following eleven pesticide-related grower behaviors:

1. Methods of pest identification.
2. Amount of crop damage allowed.
3. Methods of pesticide transportation.
4. Clothing worn while mixing and loading.
5. Clothing worn while spraying.
6. Methods of equipment calibration.
7. Methods of spray drift prevention.
8. Methods of handling spills.
9. Methods of handling leftovers.
10. Methods of pesticide container disposal.
11. Methods of pesticide and equipment storage.

These eleven pesticide-handling practices correspond to those activities stressed in the EPA core manual as well as the other training manuals in use by the individual states.

The format of the behavior questions consisted of a basic "Yes or No" impact question (e.g., Is there a difference, since training, in the methods you use to transport pesticides?) followed by an open-ended request for specific differences (for growers who perceived an impact) or specific current practices (for growers who perceived no impact). These differences or practices were then coded into a more manageable set of response categories for tabulation and comparison.

In Subsection 4.3.1 below, the reported impacts of training on grower behaviors, in both general and specific terms, are discussed for each of the five participating states. Subsection 4.3.2 relates the background characteristics of the growers to their perceived impacts of training, while Subsection 4.3.3 relates several key training variables to these reported behavioral impacts. Finally, for 8 of the 11 pesticide behaviors, Subsection 4.3.4 compares the reported methods used by those respondents perceiving no impact of training on a given pesticide-handling practice.[1] Some interpretations are offered in an attempt to ascertain whether or not those growers reportedly unaffected by training in some behavior are currently employing, for the most part, recommended techniques of handling restricted pesticides.

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[1] Note: For 3 of the 11 pesticide behaviors, followup questions were not asked of growers reporting no impact because they could not be worded in such a way as to yield meaningful information (e.g., "How much crop damage do you currently allow before applying pesticides?").

4.3.1 Reported Behavioral Impacts

A meaningful way of summarizing the extent to which the training program has reportedly influenced the behavior of growers is to compare the average number of behavioral practices reported affected by respondents in each of the five states. Exhibit 4.3-1 displays the percentage of respondents in each state who reported no impacts of training, 1 or 2 impacts, 3 or 4 impacts, and 5 or more impacts. Also presented are the mean number of affected behaviors and its standard deviation for each state.

As can be seen in Exhibit 4.3-1, about three-fourths of the growers surveyed perceived at least one of their behavioral practices to be affected by training. This fraction ranged from 70% in Iowa to 79% in Georgia, and is reflected in the mean number of reported impacts which ranged from 2.5 in Iowa to 3.7 in Georgia. Significantly more impacts per respondent were reported in Georgia than in any of the other four states; likewise, significantly fewer impacts were reported in Iowa than in any of the other four states. The numbers of reported impacts in New York, Pennsylvania, and Nebraska are not significantly different from one another at the .05 level. Each behavioral practice will now be addressed individually.

4.3.1.1 Pest Identification and Crop Damage Allowed

Growers were first asked whether or not they felt there had been a difference since training in the methods they use to determine what kind of pest is causing problems. As shown in Exhibit 4.3-2, about one-fourth of the respondents in Georgia and Pennsylvania reported differences, compared to about one-fifth of the respondents in New York and Nebraska, and less than one-eighth of the respondents in Iowa. This variation among the five states is statistically significant at the .001 level and undoubtedly reflects the circumstance that pest identification is less of an issue in the Midwest, and therefore not as heavily

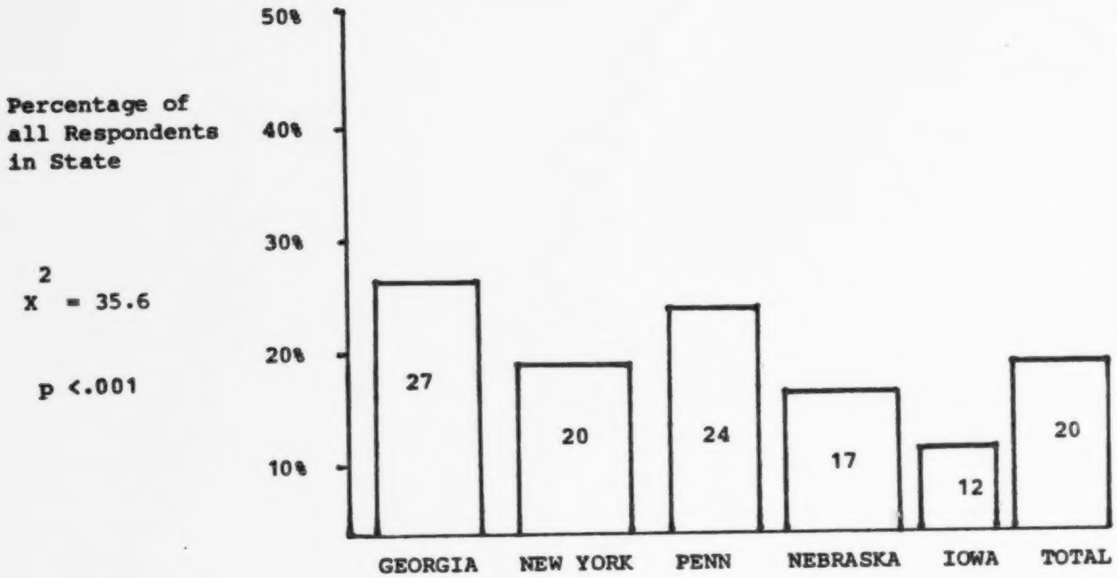
Exhibit 4.3-1

Number of Pesticide-Related Behaviors Reportedly Impacted by Training, Expressed as a Percentage of all Respondents

	GEORGIA (407)	NEW YORK (409)	PENN. (413)	NEBRASKA (407)	IOWA (413)	TOTAL (2049)
No behavioral impacts	21	26	22	22	30	24
1 or 2 behaviors	20	22	26	23	29	24
3 or 4 behaviors	23	22	22	19	21	21
5 or more behaviors	36	30	30	36	20	31
Mean number of behaviors:	3.7	3.2	3.2	3.4	2.5	3.2
Standard deviation:	3.1	2.9	2.8	2.8	2.5	2.9

Exhibit 4.3-2

Methods of Pest Identification -- Reported Differences Since Training



$X^2 = 35.6$

$p < .001$

SPECIFIC DIFFERENCES						
Better informed/better identification	5	5	7	4	3	5
Closer inspection of pest	4	2	4	3	3	3
Check with county agent	5	2	2	2	1	2
Better pest/pesticide matching	4	2	4	2	2	3
Other differences (e.g., use pest management program, more judicious spraying)	6	5	7	5	3	5

emphasized in the training programs.[1] In addition, the New York program does not emphasize pest identification because the topic received previous emphasis by the extension programs. For the five states together, pest identification was the behavioral practice least impacted by training according to these grower self-reports.

Exhibit 4.3-2 also lists specific differences in pest identification cited by the affected growers in each state. These differences include being better informed, inspecting the pest more closely, and checking with the local county agent; however, only a small percentag (<10%) of all respondents in each state mentioned any given impact. The only noteworthy variation in responses across the states is a slightly greater tendency for growers in Georgia to check with their county agents since training than in the other states.

The growers were next asked whether or not they perceived any differences since training in the amount of crop damage they allowed (before spraying) in situations where they had not planned on using pesticides (note emphasis). As shown in Exhibit 4.3-3, the percentage of growers who responded that there was still some difference in each state is very similar to the corresponding percentage for pest identification. When asked what specific differences there were in the amount of crop damage allowed, almost as many respondents said they allow less damage since training as said they allow more damage (The "Acceptable" response here being a function of the circumstances at the time the decision to use pesticides is made.) A number of growers in each state simply reported a greater awareness and concern about pesticides.

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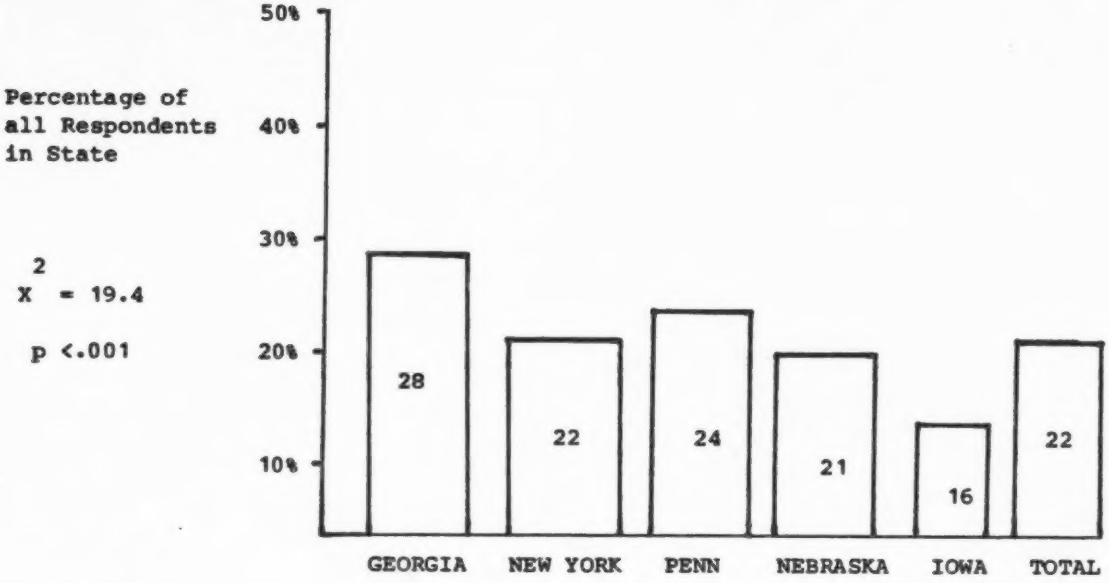
[1] Although Nebraska has great variability in crops and pests, and the training coordinator indicated that considerable effort was spent in training on the topic of pest identification, only 17% reported differences since training in methods used to determine what kind of pest is causing the problem; over 4% of those specifically mentioned better informed pest identification. It is not possible to determine the percentages of growers who reported no differences since training in pest identification because of complete knowledge in the area prior to training.

Exhibit 4.3-3

Amount of Crop Damage Allowed -- Reported Differences Since Training



$X^2 = 19.4$

$p < .001$

SPECIFIC DIFFERENCES

Allow more damage	8	7	8	5	3	6
Allow less damage	7	4	5	7	2	5
Other differences (e.g., greater awareness or concern about pesticides)	11	7	9	8	7	9

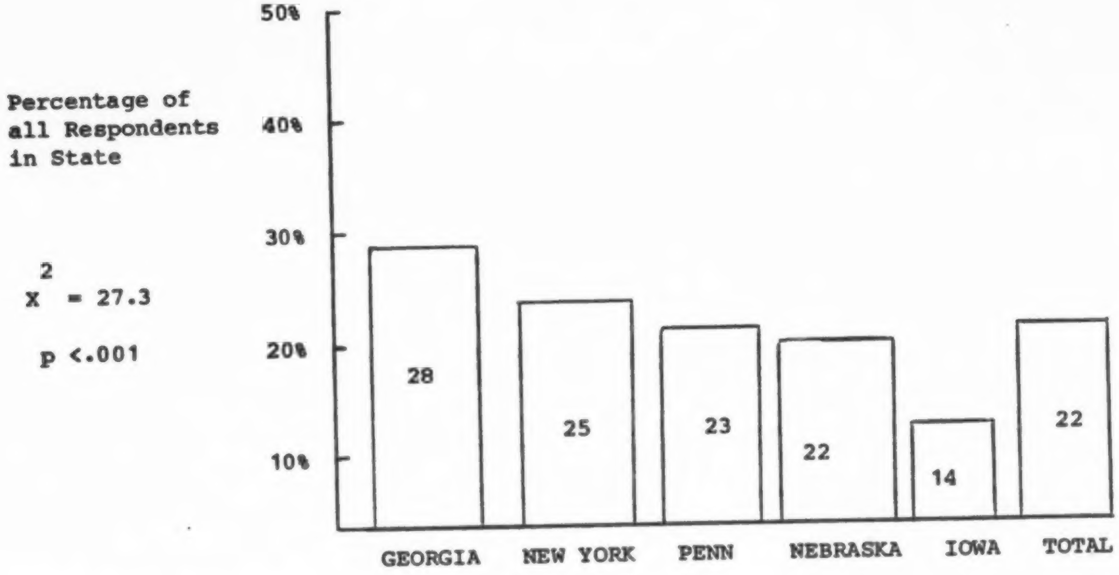
4.3.1.2 Pesticide Transportation

When asked about differences since training in their methods of transporting pesticides, twice as many growers in Georgia reported differences (28%) as in Iowa (14%), with an overall average of 22%, as shown in Exhibit 4.3-4. When probed for specifics, the most common response in each state was that the grower was simply more careful after training in transporting pesticides than prior to training, except in Georgia where the modal response was more specifically a shift in pesticide location from inside the truck (or car) to the truck bed (or trunk), as recommended in training. Other growers, especially in Georgia and New York, cited the training as a reason for transporting their pesticides in a closed (fastened-down and/or leak-proof) container in the bed of the truck or for having them delivered. Overall, however, less than 10% of the total sample of 2049 respondents mentioned any single impact of training on their methods of pesticide transportation. As will be discussed in greater detail in Subsection 4.3.4, a substantial proportion of the nonimpacted growers reported no impact related to pesticide transportation because they were already hauling them appropriately.

4.3.1.3 Pesticide Mixing and Loading

The most substantial impact reported by growers in each of the five states was in response to a question asking whether or not there were differences since training in the protective clothing worn and equipment used by the grower when mixing and loading pesticides that have a skull and crossbones symbol on the label. Overall, 44% of the total sample perceived some difference, coupled with another 15% who did not mix and load such pesticides, leaving only 40% who said there were no differences and 1% who did not know. Statistically significant variation in impacts is again observed among the states (see Exhibit 4.3-5), with Nebraska, Georgia and New York appearing above the average for the total sample, and Pennsylvania and Iowa showing below the average but nevertheless substantial perceived impacts on this behavioral area.

Exhibit 4.3-4
Methods of Pesticide Transportation -- Reported Differences Since Training

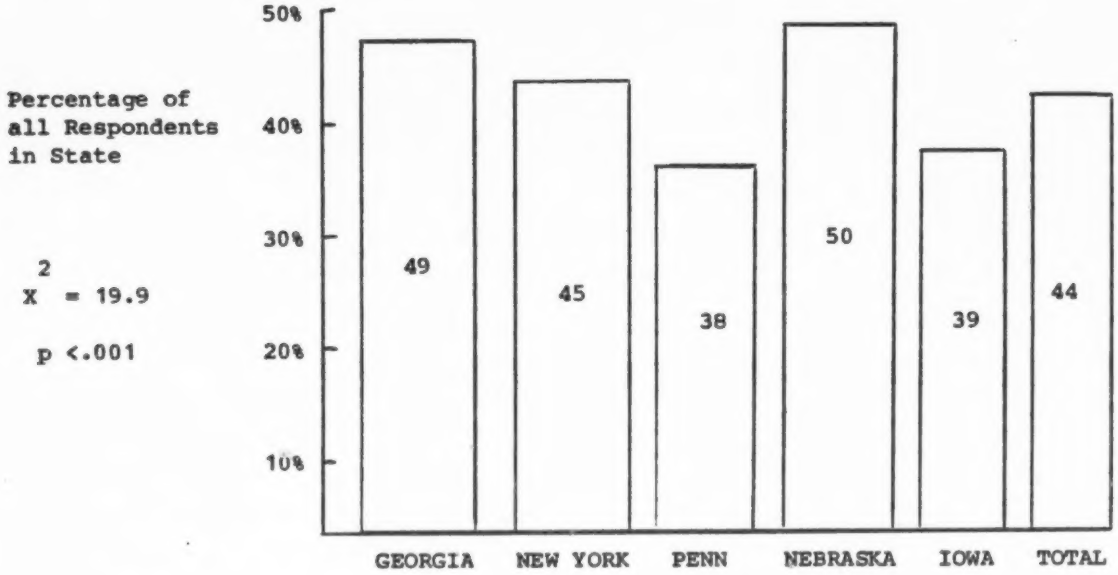


SPECIFIC DIFFERENCES

More careful in general	8	11	10	10	6	9
Keep in truck bed or trunk	10	5	5	6	3	6
Keep in closed container	7	7	4	3	3	5
Other differences (e.g., have pesticides delivered, keep away from children and animals)	6	6	7	6	3	5

Exhibit 4.3-5

Clothing Worm While Mixing and Loading -- Reported Differences Since Training



SPECIFIC DIFFERENCES

	GEORGIA	NEW YORK	PENN	NEBRASKA	IOWA	TOTAL
Waterproof gloves	36	35	29	43	32	35
Waterproof boots	6	8	6	2	2	5
Long-sleeved shirt	12	6	9	6	8	8
Long trousers	2	2	2	3	1	2
Goggles or glasses	14	10	12	24	20	16
Respirator or filter mask	9	15	14	6	5	9
Dust mask	18	14	8	11	7	11
Hat	4	2	8	5	1	4
Coveralls	5	6	8	5	3	5
Raincoat or rainsuit	8	15	6	5	1	7
Other differences	2	1	1	3	1	2

In terms of specific differences, the largest single impact reported for any behavior is the use of waterproof gloves while mixing and loading toxic pesticides. In Nebraska, 43% of all growers surveyed (50% of those who mix and load toxic pesticides) cited waterproof gloves as an item which they now wear but did not wear prior to training. Similarly impressive, though somewhat lower, percentages are found for this item in the other four states. The use of goggles (or glasses) is the second most important impact of training on pesticide mixing and loading (cited by 16% of all respondents) and again has its strongest showing in Nebraska where one out of four respondents attributed their use of goggles to the training program.

New York had the highest percentage of growers (29%) who reported being influenced by training to wear a respirator, filter mask or dust mask, with Iowa recording the lowest percentage (12%) influenced. While a simple dust mask (with no filter or eye protection) is not considered acceptable protection for mixing and loading most toxic pesticides, it is possible that many repondents used the term to refer to approved masks with charcoal filters and/or other safety features.

Another element in the New York responses to be noted is the considerably higher percentage (15%) of applicators who reported wearing a waterproof raincoat or rainsuit since training than in the other states. It is important, however, to bear in mind the differences in climate among the states when comparing impacts on protective gear; if the heat is uncomfortable, it would be unrealistic to expect growers to wear waterproof rainsuits, even if rubber suits provide the best protection. Further, the type of pesticide being used is another variable which would legitimately affect differences in behaviors across the states.

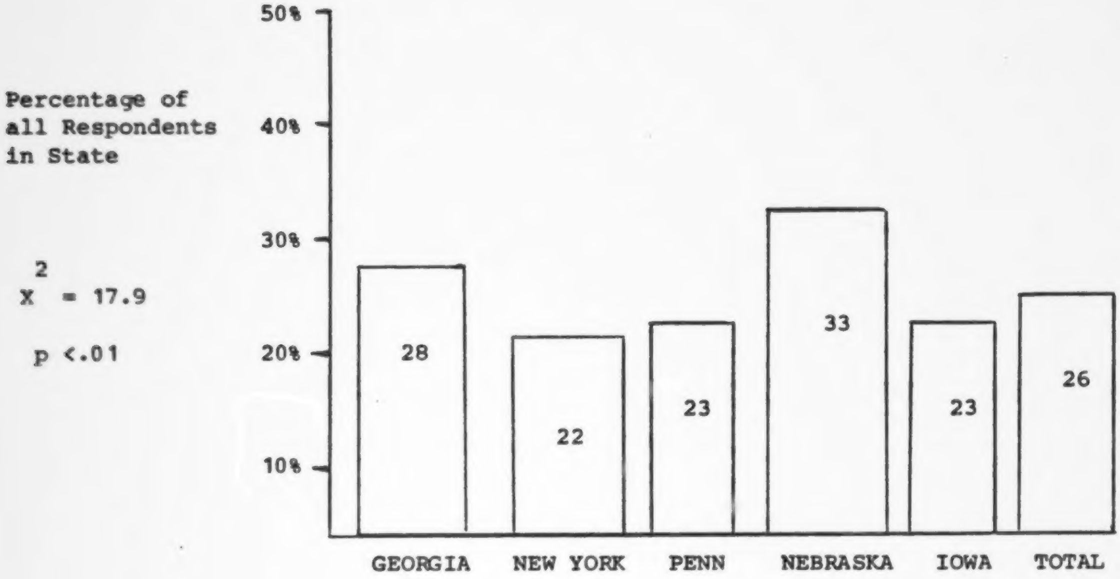
4.3.1.4 Frequency of Equipment Calibration

Over one-fourth (26%) of the 2049 private applicators surveyed perceived differences since training in the methods by which or frequency with which they calibrate their application equipment (i.e., determine how much pesticide their applicator delivers per acre). In Nebraska, where equipment calibration receives heavy emphasis in both initial training and recertification training, a full one-third of the respondents reported a difference, as seen in Exhibit 4.3-6, followed by 28% in Georgia and 22% or 23% in the remaining states. More careful calibration or measurement was the predominant difference mentioned by the growers (15% of the total sample, 21% in Nebraska), with only 4% of all respondents stating that they calibrate their equipment more frequently since training. Other differences, such as following instructions more closely, were reported by 8% of the total sample of respondents. Careful calibration can result in substantial savings to the grower--especially in the Midwest, where greater acreage is being covered. It is interesting to note that in Nebraska, 62% of the respondents who reported no difference since training in the frequency of equipment calibration reported calibrating before each application.

4.3.1.5 Pesticide Spraying and Drift Prevention

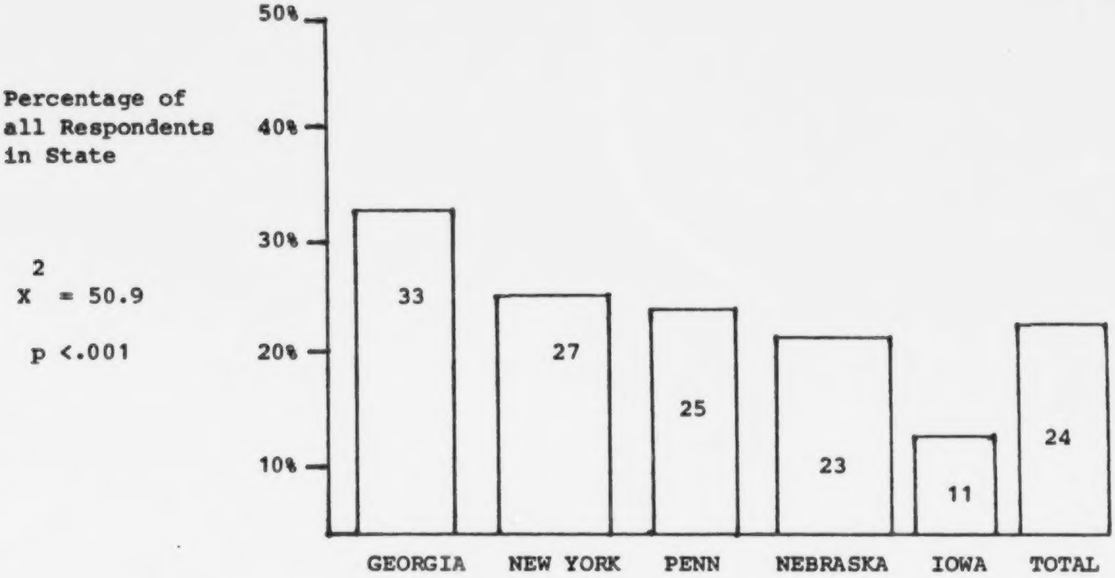
As contrasted to the substantial impacts of training reported on the respondents' protective gear worn while mixing and loading pesticides, more modest impacts of training were perceived by the growers on the protective gear worn while spraying pesticides (that have a skull and crossbones symbol on the label). Exhibit 4.3-7 displays the appropriate response percentages in each state for this behavior and shows a highly significant variation in impact across the states, with the percentage impacted in Georgia (33%) triple that in Iowa (11%). (When interpreting this variation, however, it is important to keep in mind that we have not yet presented the reported current practices of nonimpacted growers in the states to ascertain whether or not one state's private applicators seem to be any more or less in need of training than another state's.

Exhibit 4.3-6
Methods of Equipment Calibration -- Reported Differences Since Training



SPECIFIC DIFFERENCES	GEORGIA	NEW YORK	PENN	NEBRASKA	IOWA	TOTAL
Calibrate more carefully	9	9	8	15	9	10
Calibrate more often	2	3	4	5	5	4
Measure more carefully	6	6	4	6	3	5
Follow instructions more closely	4	1	3	2	2	2
Other differences	8	5	6	8	6	6

Exhibit 4.3-7
Clothing Worn While Spraying -- Reported Differences Since Training



SPECIFIC DIFFERENCES

	GEORGIA	NEW YORK	PENN	NEBRASKA	IOWA	TOTAL
Waterproof gloves	15	14	14	14	6	13
Waterproof boots	4	6	6	2	1	2
Long-sleeved shirt	12	4	7	4	3	6
Long trousers	4	2	2	1	1	2
Goggles or glasses	9	5	7	9	5	7
Respirator or filter mask	8	10	10	3	2	6
Dust mask	12	9	7	4	3	7
Hat	4	6	6	1	1	4
Coveralls	5	5	6	5	1	4
Raincoat or rainsuit	8	10	6	3	1	6
Other differences	2	0	0	1	0	1

For this analysis, see Section 4.3.4.) As with mixing and loading, the use of waterproof gloves, goggles, and respirators or masks are the most common differences in protective gear worn while spraying pesticides cited as being attributable to training. Because of Georgia's warmer climate, the relatively high percentage of growers who were motivated by training to wear long-sleeved shirts while spraying is particularly noteworthy. Again, growers in New York are more inclined to wear a raincoat or rainsuit while spraying than are other respondents in the study.

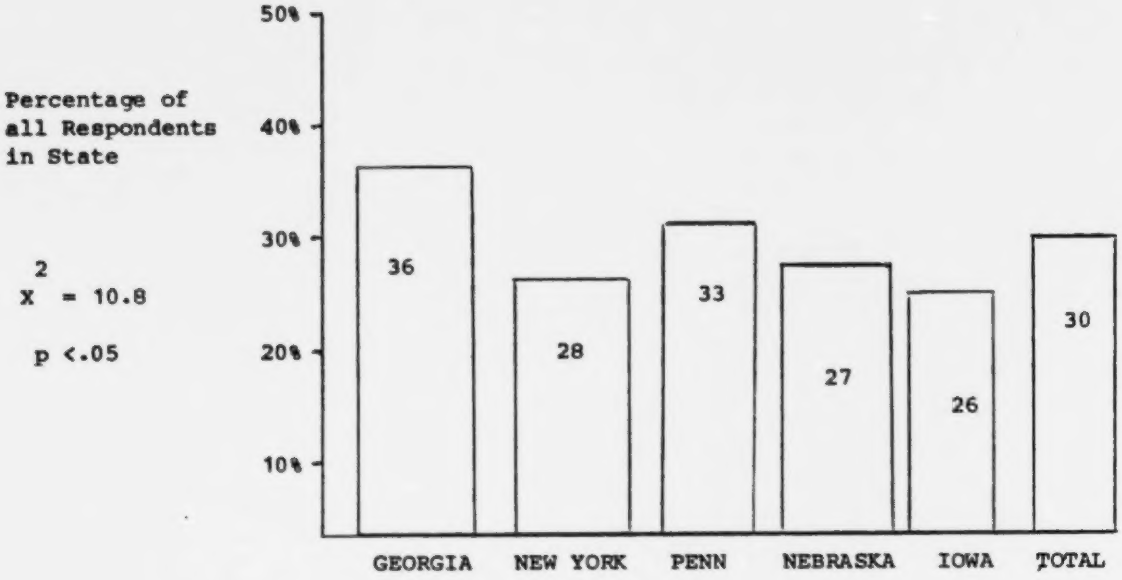
Much less variation across the states can be observed in Exhibit 4.3-8, which shows the percentage of private applicators in each state who perceived differences since training in the methods they use to control pesticide spray drift. Slightly greater than one-third of the respondents reported at least one difference in Georgia and Pennsylvania; slightly less than one-third in the remaining three states. By far the most commonly reported specific difference cited due to training was the tendency to spray when the wind is low, a difference mentioned by 21% of the total sample and ranging from 16% in Iowa to 26% in Georgia. Other new methods employed since training were spraying according to wind direction (7% overall), use of lower pressure or a large nozzle opening (6%), spraying during cooler times of the day (2%), and use of a drift control agent (2%).

4.3.1.6 Handling Pesticide Spills and Leftovers

When asked if there were any difference since training in what the grower would do if he or she spilled a small amount of the undiluted pesticide on his or her skin or clothing, a sizeable 37% of all respondents answered affirmatively; their pesticide handling practices had been positively affected as a result of training. The percentage of growers reportedly influenced by training, as shown in Exhibit 4.3-9, was considerably higher in Georgia and Nebraska (43% in both) than in New York and Iowa (34% in both), and Pennsylvania (32%). The heavy emphasis during training placed on proper spill handling behavior in Georgia and Nebraska may account for these differences, as well as the type of pesticide being

Exhibit 4.3-8

Methods of Spray Drift Prevention -- Reported Differences Since Training



$X^2 = 10.8$

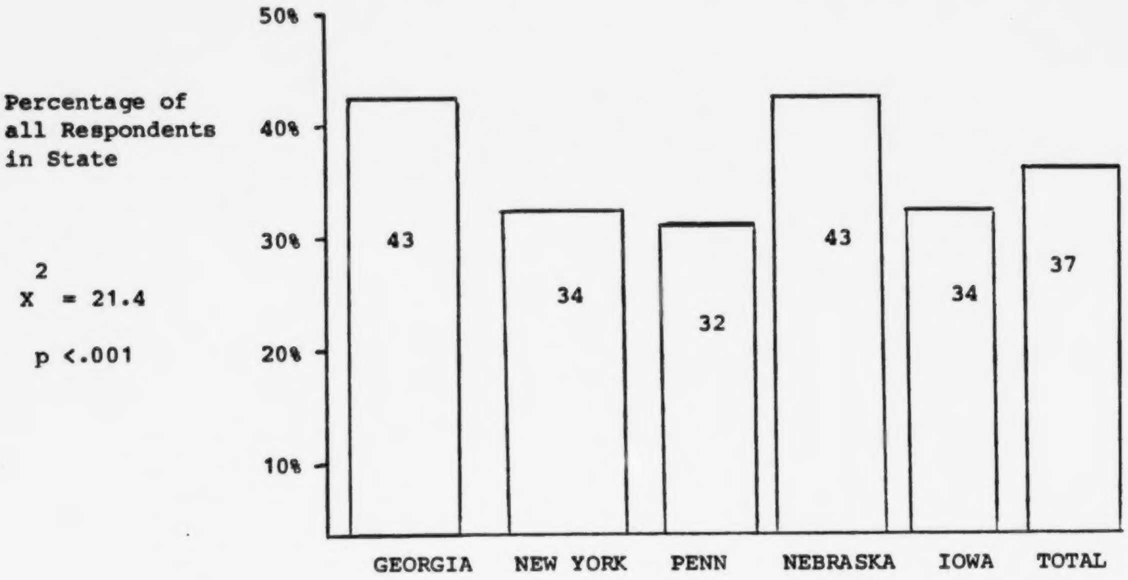
$p < .05$

SPECIFIC DIFFERENCES

	GEORGIA	NEW YORK	PENN	NEBRASKA	IOWA	TOTAL
Spray when wind is low	26	20	24	17	16	21
Spray with wind direction	9	5	9	6	3	7
Spray during cooler times	2	2	2	0	2	2
Use lower pressure	3	2	1	3	7	3
Use larger nozzle opening	2	1	2	4	6	3
Use a drift control agent	2	0	1	2	2	2
Spray closer to ground	3	4	5	1	1	1
Other differences (e.g., not when raining)	7	9	10	9	9	9

Exhibit 4.3-9

Methods of Handling Pesticide Spills -- Reported Differences Since Training



$X^2 = 21.4$

$p < .001$

SPECIFIC DIFFERENCES	GEORGIA	NEW YORK	PENN	NEBRASKA	IOWA	TOTAL
Wash more quickly	15	13	10	14	12	13
Wash more thoroughly	20	13	13	19	13	16
Remove clothing	17	9	9	16	14	13
More careful in general	3	5	2	4	3	3
More likely to read label	2	2	1	0	1	1
Other differences (e.g., contact physician, keep poison control phone No.)	3	4	5	6	1	4

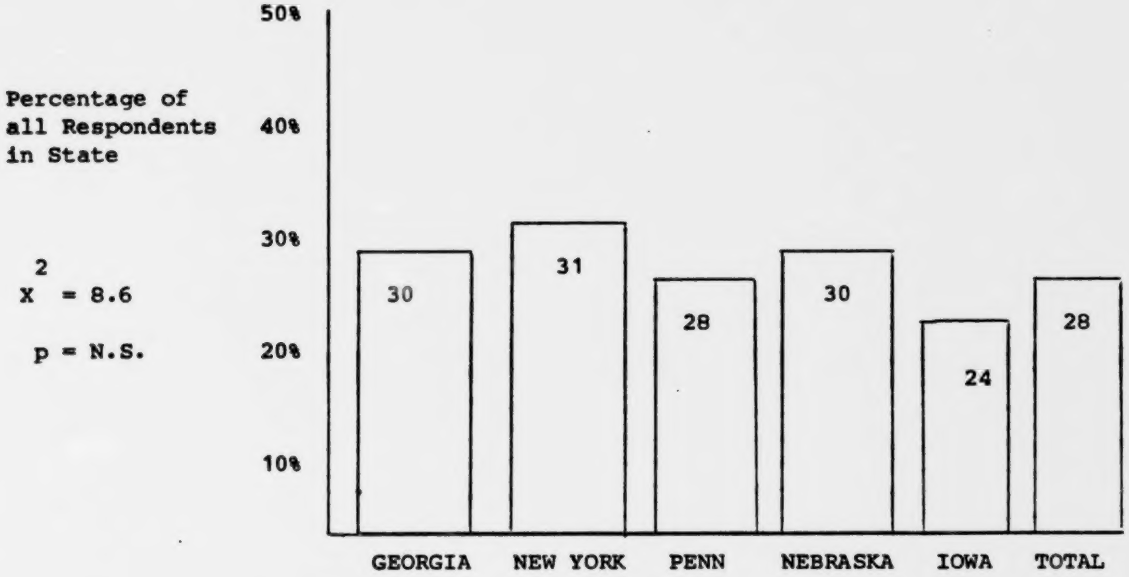
applied when the spills occur. Nonetheless, three specific differences dominated the responses obtained when asked for details: 16% would wash more thoroughly; 13% would wash more quickly; and 13% of all respondents would remove clothing. Other responses included a greater likelihood of reading the label, contacting a physician, or being more careful in general (8%).

The private applicators were then asked about differences since training in how they handle leftover pesticide, and 28% reported at least one difference. As shown in Exhibit 4.3-10, no significant variation in impacts appears across the states, with the range of impact between 24% for Iowa and 31% for New York. The primary difference in handling leftovers that was reported in each state is the use of a closed leak-proof container for storage (9% of the total sample), with only small percentages who continue spraying until empty. Three percent of the growers reported not having any leftover pesticide, and 8% reported taking the leftover pesticide back to a dealer. It is interesting to note that 4% of the respondents reported burying the pesticide or draining it onto the ground since training, a procedure generally recommended until very recently in most states, except Nebraska, where burying is still a recommended method. For example, 5% of the growers in Georgia now report burying or draining the leftover pesticide as a difference in their pesticide-handling practices since training. The Georgia Slide/Tape Series on "Protecting the Environment from Pesticides" suggests, if regulations permit, burying rinsed containers singly in open fields (if first punctured or broken) or burying the containers at least a foot and a half below the surface, where they cannot pollute surface or subsurface water.

4.3.1.7 Pesticide Storage and Disposal

The response percentages shown in Exhibit 4.3-11 pertaining to those private applicators who perceived impacts on their methods of storing their pesticides and equipment vary little across the states, with the exception of Iowa, which is 11% below the total sample average of 26%. In part, this may be due to general differences between eastern and

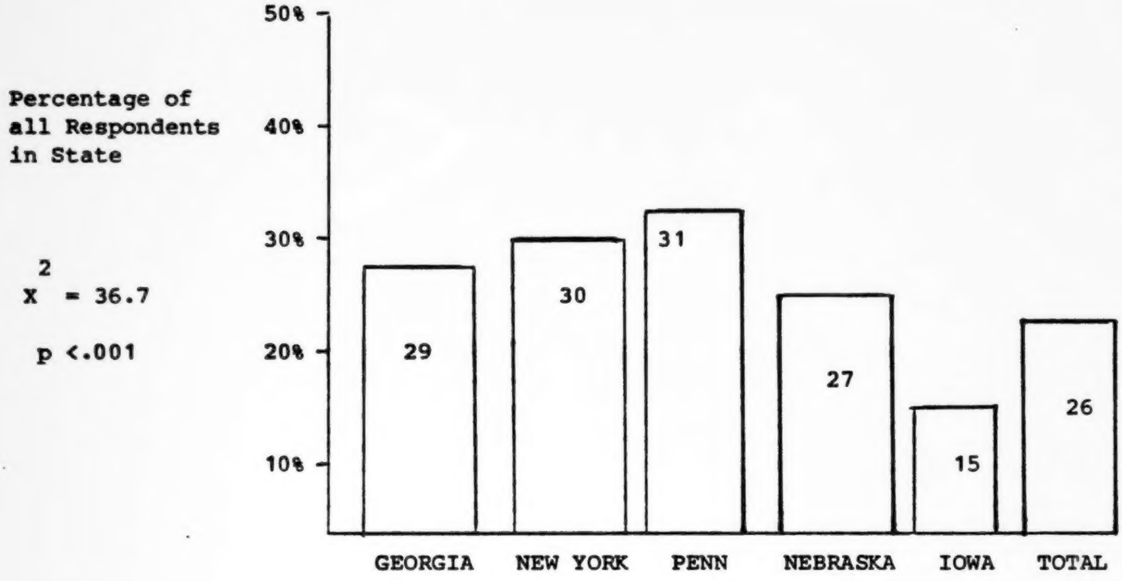
Exhibit 4.3-10
Methods of Handling Leftover Pesticide -- Reported Differences Since Training



SPECIFIC DIFFERENCES

	GEORGIA	NEW YORK	PENN	NEBRASKA	IOWA	TOTAL
Store in closed container	12	10	9	10	7	9
Drain it onto or bury it into ground	5	3	3	4	3	4
Spray same field until empty	3	3	2	2	1	2
Dilute then spray same field	1	0	1	0	0	1
Apply it to another field	0	1	2	1	2	1
Don't have any leftovers	2	3	4	3	2	3
Other differences (e.g., take it to a dealer)	6	9	6	9	6	8

Exhibit 4.3-11
Methods of Pesticide and Equipment Storage -- Reported Differences Since Training



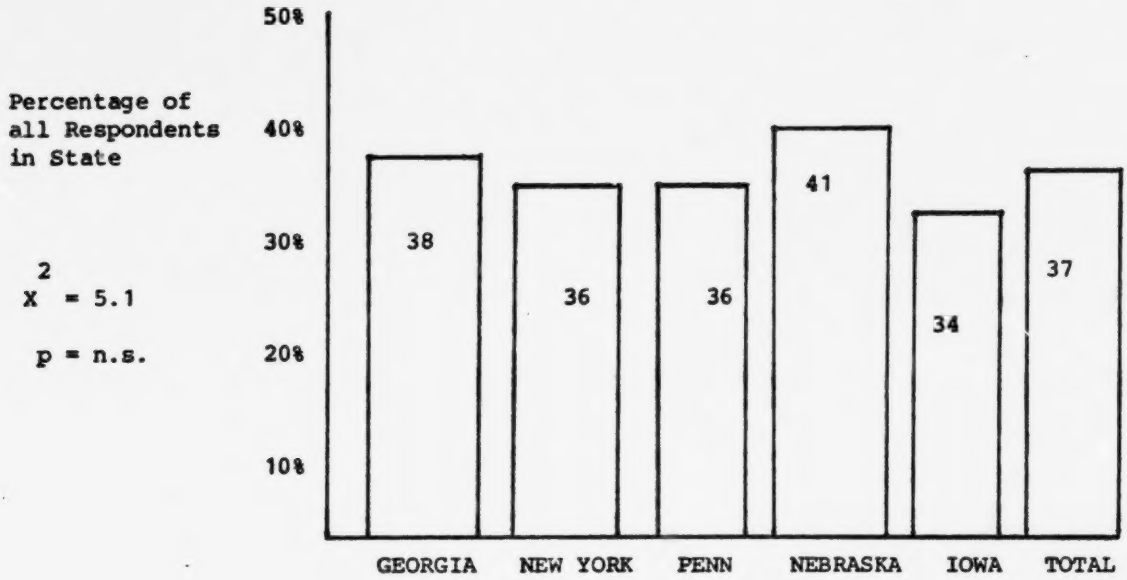
SPECIFIC DIFFERENCES	GEORGIA	NEW YORK	PENN	NEBRASKA	IOWA	TOTAL
Keep them locked	12	14	15	9	3	11
Keep them in special shed	15	13	13	12	7	12
Keep them away from children/animals	14	8	11	10	6	10
Wash/clean before storing	2	3	2	3	1	2
Store away from extreme heat	4	3	4	4	3	4
Other differences (e.g., take to dealer)	4	4	6	9	3	5

western states in likeliness to lock anything where areas are extremely rural and remote. Pennsylvania and New York record the strongest impacts on pesticide and equipment storage (31% and 30% respectively), and more specifically reported success in motivating the growers to keep their pesticides locked up (15% and 14% respectively). The other two differences in storage since training that were mentioned frequently were keeping the pesticides and equipment in a special shed or area (12%) and away from children and animals (10%). Other differences mentioned included washing or cleaning the equipment before storing, storing them away from extreme heat, or taking them to a dealer (11% other).

Finally, Exhibit 4.3-12 pertains to disposal of the empty pesticide containers and reflects consistently strong perceived impacts across the states, averaging 37% overall and ranging from 34% in Iowa to 41% in Nebraska (with no statistically significant variation). Burial of the containers was a new method attributable to training according to 15% of the total sample of private applicators especially where emphasized in Nebraska (23%), followed by burning the containers (10% of the total), rinsing them (9% overall and a more favorable 16% in Iowa), hauling them to a community landfill (7% overall), and crushing or puncturing them (6% overall). Other perceived differences included taking them to a private unlicensed trash dump (not recommended in all states but Nebraska yet cited as new behaviors by 4% of the growers), taking them to a dealer; reusing them (also not recommended); or storing them in a safe place awaiting disposal (5% other).

To summarize the perceived impacts of training on the specific behavioral practices of growers, we can rank order the eleven major behavioral practices by extent of impact, as shown below for the total sample:

Exhibit 4.3-12
Methods of Empty Container Disposal -- Reported Differences Since Training



$X^2 = 5.1$

p = n.s.

SPECIFIC DIFFERENCES

Burn them	13	8	12	12	5	10
Bury them	16	14	16	23	7	15
Rinse them	3	8	9	7	16	9
Crush or puncture them	3	6	6	7	7	6
Haul them to a landfill	11	7	3	7	9	7
Take them to a dump	5	5	3	2	3	4
Store them in a safe place awaiting disposal	3	1	1	0	1	1
Other differences (e.g., take them to a dealer re-use them)	3	4	3	4	5	4

Rank Order	Pesticide-Related Behavior	% of all Respondents in the Study who Perceived Impacts Attributable to Training
1	Clothing worn while mixing and loading	44
2	Methods of handling spills	37
3	Methods of container disposal	37
4	Methods of spray drift prevention	30
5	Methods of handling leftovers	28
6	Frequency of equipment calibration	26
7	Methods of pesticide and equipment storage	26
8	Clothing worn while spraying	24
9	Methods of pesticide transportation	22
10	Amount of crop damage allowed	22
11	Methods of pest identification	20

Generally, behaviors pertaining to personal safety appear at the top of the list of behavioral impacts, while behaviors pertaining to environmentally safe procedures or avoiding unnecessary usage generally seem to be less affected by training. Overall, however, impacts of training were perceived by at least 20% of the growers for all eleven behavioral practices.

4.3.2 Reported Behavioral Impacts by Background Characteristics

The private applicators' perceptions of differences since training in their methods of handling pesticides were examined in relation to six background characteristics of the respondents: age, education, years of pesticide experience, acres farmed, pesticide applications per year, and pesticide expenditures last year. Spearman nonparametric correlation coefficients were computed relating each background variable to the total number of behavioral impacts reported by each grower (as distinguished from correlations between background variables and reported overall value of training and certification). In the following subsection, those associations which are statistically significant at the 95% confidence level are described.

Respondent's age. For the growers in Georgia, New York, Nebraska, and Iowa, there was no significant association between the respondent's age and his number of reported behavioral changes since training, indicating that in these states the older growers were no more or less likely to feel affected by training than the younger growers. In Pennsylvania, a mild negative association (r = -.10) exists between age and number of reported impacts, indicating that in this state there were somewhat more behavioral differences since training reported by the younger private applicators surveyed. In particular, this negative age/impact association in Pennsylvania appears in the behavioral areas of pest identification (r = -.11), amount of crop damage allowed (r = -.13), and equipment calibration (r = -.13).

Respondent's education. There are no significant correlations in any of the states between the respondents' education level and his number of reported impacts of training except in Pennsylvania, where a moderate positive association (r = .18) exists. The more educated Pennsylvania private applicators tended to report more differences since training in their pesticide handling practices than the less educated growers, especially in the areas of pest identification (r = .25), pesticide drift prevention (r = .18), clothing worn while spraying (r = .14) or while mixing and loading (r = .13), and amount of crop damage allowed (r = .11). Since Pennsylvania is unique among the states in having trained a majority of its private applicators via self-study (correspondence) methods, a plausible explanation for these unique age and education effects in the state might be that the younger and more educated growers benefit more from training than the older and less educated growers if and only if the training takes the form of self-study. This hypothesis is examined more closely in Chapter 7: Pennsylvania Evaluation Report.

Years of experience. No significant association appears in any of the states between a respondent's years of experience using pesticides and his number of perceived impacts of training; however, in Pennsylvania (and consistent with the age and education effects) there is a greater tendency for less experienced private applicators to report some behavioral impact in the area of pest identification (r = -.17), pesticide transportation (r = -.10), and pesticide drift prevention (r = -.08).

Acres farmed. No significant correlation exists in any of the five states between acres farmed and number of reported behavioral impacts; however, in Georgia, New York, and Pennsylvania several significant and negative associations of farm size with individual behavioral impacts were found. Growers with small farms more often reported training impacts than larger scale growers in the areas of pest identification (r = -.12 in Georgia and Pennsylvania), pesticide transportation (r = -.12) in Georgia and r = -.10 in New York), and pesticide and equipment storage (r = -.17 in New York and r = -.09 in Georgia and Pennsylvania). While the training program overall seems to have impacted the big farmer as much as the small farmer, it is likely that in the three behavioral areas above, many large-scale farmers had already received some information from cooperative extension agents about correct procedures prior to formal training (and hence were not as likely to be influenced by "new information" in formal training as small-scale farmers with less experience).

Pesticide application per year. In New York, Nebraska, and Pennsylvania there is a slight positive association (r = .10) between frequency of pesticide application and number of perceived behavioral changes. Those private applicators in these states who spray their fields many times a year tended to report more differences since training in their behavior than those who spray only once or twice a year. More frequent users particularly tended to report more differences in their protective clothing worn while spraying and their pesticide storage practices. One explanation for this effect might be that the training programs were geared more toward the insect pest problem (requiring multiple applications) than other pest problems (for example, annual soil application in Iowa). Another might be that the more frequent pesticide users are more often reminded of and, hence, more aware of training effects on their pesticide practices than less frequent users. It should be noted that growers who reported not having applied pesticides in the last three years were excluded from the computation of correlations between behavioral impacts and application frequency, since these growers skipped the behavioral section of the interview.

Pesticide expenditures last year. In all study states except Nebraska, no significant association exists between level of 1980 pesticide expenditures (less than $1000; $1000-$5000; more than $5000) impacts of training on behavior. In Nebraska, there is a mild but statistically significant positive tendency for those growers who spend over $5000 annually on pesticides to report more behavioral impacts than those who spend less ($r = .10$). This positive relationship between 1980 expenditures and individual behavior changes in Nebraska is somewhat surprising, since several significant negative associations exist in the other states pertaining to expenditures and individual behavior changes, i.e., the respondents who spend most on pesticides are less likely than others to report impacts of training on their methods of pest identification (Pennsylvania $r = -.10$), Iowa $r = -.09$), pesticide transportation (Georgia $r = -.10$), and pesticide storage (Georgia $r = -.13$). Theoretically, cost correlates with quantity, and the greater the quantity of pesticides used, the greater the potential effect of training on pesticide transportation and storage.

4.3.3 Reported Behavioral Impacts by Training Characteristics

The growers' perceptions of differences in behavior since training were also examined in relation to four training-related variables: year of initial certification, training type (session vs. self-study), overall assessment of training worth, and source of pesticide assistance (chemical dealer versus county agent). As in Subsection 4.3.2, only statistically significant (at the 95% confidence level) associations are reported here, and their causal directions are speculated but not assumed.

Year of initial certification. No linear relationship between the respondents' year of certification and number of reported impacts was found in any of the states, indicating that those private applicators trained relatively recently (1978 to 1980) perceived as many changes in their behavior as private applicators trained early (1975 to 1977). This lack of association also exists for each of the behavioral practices individually, except that in Iowa a negative correlation ($r = -.11$) was found between year certified and behavior changes in the areas of pesticide transportation, disposal and storage. For these three practices, early trainees in Iowa seem to have benefited slightly more than later trainees. This may be due in part to the growing consensus among private applicators in Iowa that training and certification became a mere inconvenience and expense when few, if any, commonly used pesticides were restricted.

Training type. Perhaps the most important and unexpected lack of association among the study variables is that there is no difference in reported behavioral impacts between respondents who were trained via self-study and those who were trained via group sessions. Since the number of self-study respondents is very small in Nebraska, Iowa, and Georgia, only the lack of association in Pennsylvania and New York should be considered meaningful. Both in terms of number of behavioral practices (reportedly) impacted, and in terms of whether or not any individual practice was (reportedly) impacted, no significant difference was found between the self-study and training session groups. It is still possible, however, that one group reported more specific differences within a given pesticide behavior (e.g., locking up pesticides when storing) than the other group, or that a bivariate association within one group (e.g., between education and reported impacts) does not exist within the other group. These possible "higher level" differences between the two types of training participants are examined as part of a special discussion of the training session versus self-study methods contained in Chapter 7: Pennsylvania Evaluation Report.

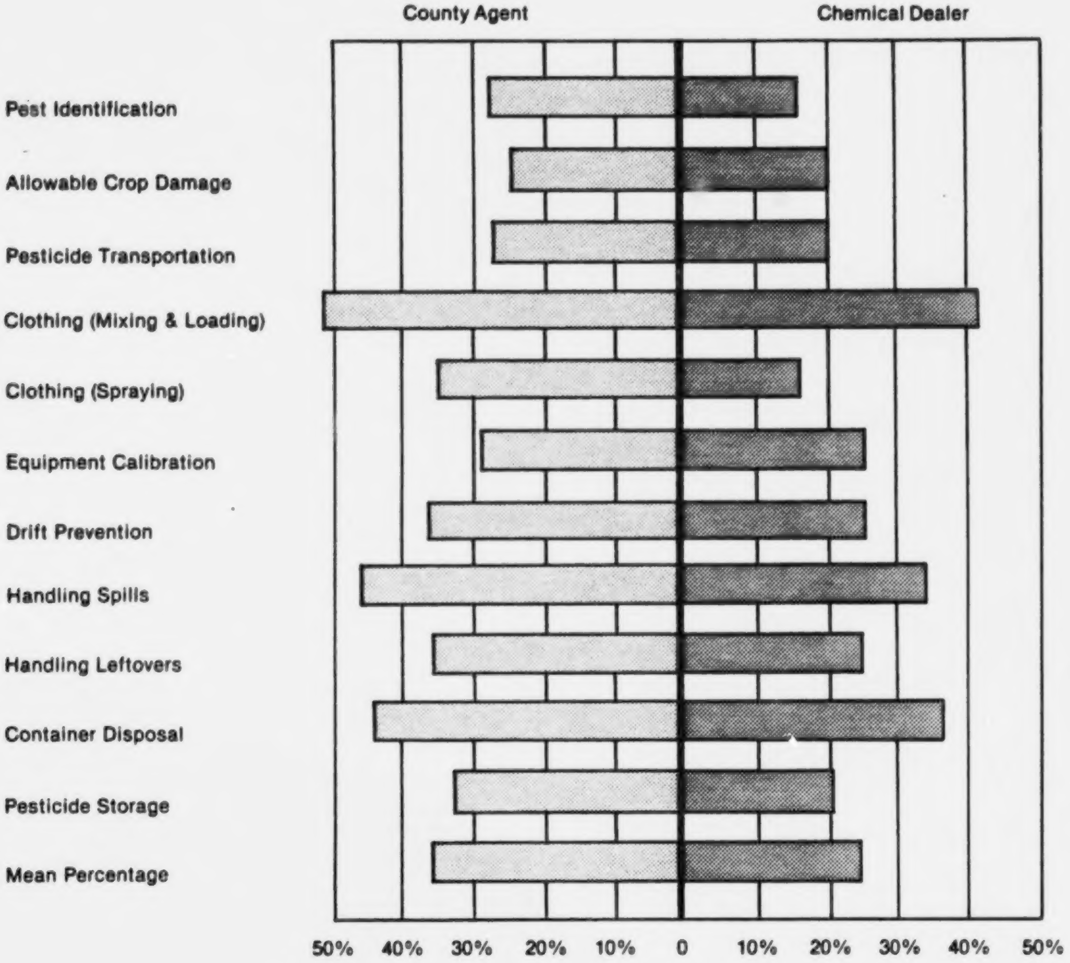
Assessment of training worth. As might be expected, there is a strong positive relationship in each of the participating states between a respondent's total number of perceived impacts and his rating of training worth ($r = .33$ for the total sample). Those private applicators who perceived many differences in their behavior since training tended to rate the training considerably more favorably than those who perceived few, if any, differences in their behavior, especially in New York ($r = .35$) and Iowa ($r = .35$) and less so in Pennsylvania ($r = .26$). It is impossible to say, however, whether the respondent tended to rationalize his opinion of training by understating or overstating changes in his behavior, or whether the respondent truly rated the program value according to the extent to which he felt influenced by its content. Under the circumstances of the study, it seems unlikely that respondents were less than candid in their evaluation of impacts on specific behaviors, and the generally more positive rating among those more positively impacted is neither unexpected nor without value in the overall assessment.

Source of Pesticide Assistance. While not a characteristic of training per se, it is interesting to note that in four of the five states in the study, the growers who stated that they would most likely go to their local county agent (as opposed to a chemical dealer) for pesticide assistance tended to report more impacts of training (r = .16 for the total sample). This relationship appears in Pennsylvania (r = .16), Georgia (r = .15), and New York (r = .14), but not significantly in Nebraska (r = .08) and Iowa (r = .08). The pattern for those most likely to go to their county agents to be most influenced by training is even more pronounced when individual pesticide behaviors are examined, as shown in Exhibit 4.3-13. Especially in the areas of protective clothing, pesticide storage, drift prevention, and pest identification, those growers who primarily consult their county agents for assistance appear to feel considerably more impacted by training than those growers who primarily consult their chemical dealers (in each individual state as well as overall).

4.3.4 Reported Behavioral Practices of Respondents Reporting No Behavioral Differences Since Training

For 8 of the 11 pesticide-handling practices included in the survey, those respondents who perceived no differences since training on a given behavior were asked, in an open-ended way, how they currently performed that behavior. For each behavioral question, their responses have been categorized and the percentage of "nonimpacted" growers that gave a particular response is listed. It is important to bear in mind that "nonimpacted" in this context only refers to the fact that the respondent reported no difference since training with respect to a given behavioral area. This does not mean that the training had no benefit to the respondent in other areas; it only indicates that no change since training was made by the grower in this behavioral area.

Exhibit 4.3-13
Percentage of Respondents Reporting Differences Since Training by Behavior Practice and by Primary Source of Assistance



In interpreting the data, it is also important to be cognizant of the climatic and agricultural differences among the states as well as the fact that no cues were employed (e.g., "Do you wear rubber gloves?") to trigger the responses which were later categorized for analysis. Also, with the exception of pesticide transportation and equipment calibration, the grower could give more than one response (e.g., article of clothing) to each question, resulting in nonadditive response percentages.

Pesticide transportation. Those private applicators who said there was no difference since training in the methods they use to transport pesticides were asked how they currently transport their pesticides. Exhibit 4.3-14 shows that, overall, 93% of the nonimpacted growers transport their pesticides in the bed of their truck or the trunk of their car, which conform to the recommended locations for hauling pesticides. A high of 97% is found in Iowa which may partially explain the lower behavioral impact of training on transportation of pesticides in Iowa than in the other states surveyed. Overall, only 4% report placing them (unwisely) in the cab of the truck or the seat of the car, less so in Iowa and Nebraska (2% in each state) than in the other three states (at least 5% in each state). In part, this may have to do with the quantity of pesticides which are carried at any one time. Other methods cited include placing them in a closed (leak-proof and/or tied-down) container usually in the bed of the truck, an acceptable transporting procedure.

Clothing worn while mixing and loading. Exhibit 4.3-15 shows the percentage of nonimpacted respondents in each state who reported wearing specific protective gear while mixing and loading pesticides that have a skull and crossbones symbol on the label. In all states except Georgia, well over one-half of the nonimpacted growers said that they wore waterproof gloves. The two midwestern states report the highest usage of waterproof gloves (73% in Nebraska and 69% in Iowa) as well as protective goggles or glasses (51% in Iowa and 33% in Nebraska), with Georgia reporting only 48% who wear waterproof gloves, 18% who wear safety goggles, and the highest percentage (19%) who say they wear no protective gear.[1]

Particularly impressive, in terms of other protective gear worn, are the nonimpacted growers in New York. The percentages of these growers who report wearing waterproof boots (26%), a respirator or filter mask (34%), and/or a raincoat or rainsuit (26%) are more than double the corresponding five-state average, and New York also has the highest percentage who they wear dust masks (29%, and likely interpreted to mean filter masks in many instances), a hat (25%), and even coveralls (28%). Again, it is important to bear in mind that New York has a considerably cooler spring climate than at least three of the other states, and its private applicators use such highly toxic insecticides as Parathion, which is not used by private applicators in Nebraska and Iowa. Surprisingly, Pennsylvania respondents report significantly lower usages of waterproof gear than New York, despite higher comparability in climate, crops, and common pesticides.

Clothing worn while spraying. Exhibit 4.3-16 lists the clothing and protective gear reportedly worn while spraying pesticides with a skull and crossbones symbol on the label in each of the five states (among nonimpacted growers). The percentages in most instances drop considerably from those in the previous (mixing and loading) exhibit, with a corresponding increase in the percentages who say they wear no protective gear while spraying (21% overall). New York now shows the highest percentage (53%) of nonimpacted growers who say they wear waterproof gloves while spraying, with Georgia again having the lowest usage of gloves (29%). Only 10% of New York private applicators unaffected by training reported not wearing or needing to wear protective gear while spraying, contrasted with a high of 32% in Nebraska. Some of this

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[1] The pesticides used in Nebraska which have skull and crossbones do not generally require the use of rubber gloves or other special protective equipment. The granular corn rootworm insecticides are used on a large percentage of the corn crop. For this reason, it is a surprise that so many respondents reported were wearing rubber gloves.

Exhibit 4.3-14
No Difference Respondents --Methods of Pesticide Transportation

Response Category	GEORGIA	NEW YORK	PENN.	NEBRASKA	IOWA	TOTAL
	(Percentage of Nonimpacted Respondents)					
● Bed of Truck	89	86	79	91	95	89
● Trunk of Car	4	5	11	2	2	4
● Trunk cab/car seat	5	6	5	2	2	4
● Other methods (e.g., closed container)	2	3	5	5	1	3
Total	100	100	100	100	100	100

Exhibit 4.3-15
No Difference Respondents -- Clothing Worn While Mixing and Loading

Response Category	GEORGIA	NEW YORK	PENN.	NEBRASKA	IOWA	TOTAL
	(Percentage of Nonimpacted Respondents)					
• Waterproof gloves	48	68	61	73	69	64
• Waterproof boots	7	26	15	5	4	12
• Long sleeved shirt	26	18	25	22	33	25
• Long trousers	23	10	18	12	19	16
• Goggles or glasses	18	21	20	33	51	29
• Respirator/filter mask	11	34	23	8	8	17
• Dust mask	23	29	19	21	19	22
• Hat	9	25	20	8	12	15
• Coveralls	16	28	26	23	19	22
• Rainsuit or raincoat	7	26	15	4	0	10
• Other clothing	5	5	5	6	1	4
• None worn/necessary	19	10	11	13	7	12

Exhibit 4.3-16
No Difference Respondents -- Clothing Worn While Spraying

Response Category	GEORGIA	NEW YORK	PENN.	NEBRASKA	IOWA	TOTAL
	(Percentage of Nonimpacted Respondents)					
• Waterproof gloves	29	53	41	40	37	40
• Waterproof boots	9	26	15	6	5	12
• Long sleeved shirt	29	20	28	22	33	27
• Long trousers	25	13	21	14	21	19
• Goggles or glasses	17	20	14	18	29	20
• Respirator/filter mask	11	33	21	4	5	15
• Dust mask	20	21	17	8	10	15
• Hat	18	34	25	13	15	21
• Coveralls	18	26	27	19	23	23
• Rainsuit or raincoat	8	32	13	5	1	11
• Other clothing	2	3	5	6	2	4
• None worn/necessary	21	10	15	32	24	21

difference could be a result of more common usage in Nebraska of such granular pesticides as Carbofuran which does have a skull and crossbones symbol on the label but which does not require much in the way of personal safety protective gear. The New York percentages of those wearing waterproof boots (26%), respirators, filter masks,(which includes charcoal cartridge, vapor, or nose masks) or dust masks (54%), hats (34%), and raincoats or rainsuits (32%) are again much higher than in the other states and significantly higher in many categories than Pennsylvania where--compared to New York--similar pesticides may be used but are not considered restricted pesticides.

Equipment calibration. When asked how frequently they calibrate their application equipment, the nonimpacted respondents in New York and Pennsylvania tended to give a very different answer than other growers, especially those from Nebraska. As shown in Exhibit 4.3-17, 62% of the nonimpacted private applicators in Nebraska said they calibrated their equipment before each application, nearly twice the corresponding percentage in New York (34%). By contrast, the percentages in New York and Pennsylvania who said they calibrated their equipment less than every 3 or 4 applications (31% and 30%) were nearly twice the corresponding percentage for either Nebraska (15%) or Gerogia (17%) and considerably higher than Iowa (20%). Generally, growers are encouraged to calibrate their equipment before each application, although the type of equipment being used is a consideration, as is the total acreage treated during any single application. With large farms such as those in Iowa and Nebraska, this is especially important since improperly adjusted equipment can cost the grower (and the environment) in terms of pesticide excess. With the small farm sizes in New York and Pennsylvania, along with multiple sprayings per year (for insect problems in particular), it is not surprising that calibration is done less often in these states than in the Midwest.

Methods of drift prevention. As shown in Exhibit 4.3-18, by far the most commonly employed method of preventing pesticide drift is to spray when the wind is low, as reported by 80% of all nonimpacted

Exhibit 4.3-17
No Difference Respondents — Frequency of Calibration

Response Category	GEORGIA	NEW YORK	PENN.	NEBRASKA	IOWA	TOTAL
	(Percentage of Nonimpacted Respondents)					
• Before each application	58	34	41	62	49	46
• Before every other application	11	7	7	8	11	8
• Before every 3 or 4 applications	12	18	16	10	12	13
• Less often	17	31	30	15	20	22
• Other (once a year)	2	6	6	5	7	6
	100	100	100	100	100	100

Exhibit 4.3-18

No Difference Respondents -- Methods of Drift Prevention

Response Category	GEORGIA	NEW YORK	PENN.	NEBRASKA	IOWA	TOTAL
	(Percentage of Nonimpacted Respondents)					
● Spray when wind is low	74	82	84	81	80	80
● Spray by wind direction	16	12	7	16	15	13
● Spray at cooler times	3	6	4	1	3	4
● Use lower pressure	5	4	7	12	20	10
● Use larger nozzle opening	2	1	5	6	13	6
● Use drift control agent	2	2	0	3	5	2
● Spray closer to ground	12	10	12	14	12	11
● Other methods (e.g., not when raining)	15	18	14	18	20	18
● No precaution taken/ necessary	6	3	4	2	5	4

respondents. In Iowa and Nebraska in particular, the private applicators also seem to be commonly employing several other drift prevention techniques such as using lower pressure (20% and 12%, respectively), larger nozzle openings (13% and 6%), spraying closer to the ground (12% and 14%), spraying by wind direction (15% and 16%), and other methods such as spraying during cool and dry times or using a drift control agent (28% and 22%). While the two midwestern states seem to be especially attentive to spray drift prevention, the data for all five states suggest a good pretraining and posttraining awareness and use of at least a few drift prevention techniques. It should also be noted that spray drift prevention may not be an issue for many Iowa and Nebraska growers who contract with commercial applicators to do large-scale, ground-paid aerial applications and where the larger farms reduce proximity to neighbors.

Methods of handling leftovers. When asked what they do with the leftover pesticide when the job is finished, the most common response of the nonimpacted growers in each state (see Exhibit 4.3-19) was that they store the pesticide in a closed container (39% overall). To the extent that these containers are equivalent to steel drums with clamp covers, and that the storage is only for a relatively short period of time, this constitutes a manual recommended procedure for handling surplus pesticides. Another 20% of the respondents said that they continue to spray the same field until the sprayer is empty, thereby avoiding the question of what to do with leftovers. Obviously, the best way to take care of the surplus pesticide problem is not to have a surplus in the first place, and 18% of the respondents who reported no change since training in the handling of leftover pesticides said that they did not have any leftover pesticide. Other acceptable methods of handling leftovers--such as applying it to another field or taking it to a dealer--were mentioned by 17% of the private applicators not influenced by training. Leaving the pesticide in the applicator is not recommended and was cited by only 4% of these respondents, and draining it onto the ground or burying it was reported by 12% of the respondents. Little variation appears across the states in terms of methods of handling surplus pesticides.

Exhibit 4.3-19
No Difference Respondents -- Methods of Handling Leftovers

Response Category	GEORGIA	NEW YORK	PENN.	NEBRASKA	IOWA	TOTAL
	(Percentage of Nonimpacted Respondents)					
• Drain it onto or bury it into the ground	13	7	6	16	17	12
• Leave it in applicator	5	4	5	3	1	4
• Apply it to another field	4	3	6	8	3	5
• Continue to spray same field until applicator is empty	19	17	18	17	18	18
• Dilute, then spray same field until applicator is empty	3	3	2	0	2	2
• Store in closed container	39	41	44	31	39	39
• Don't have any leftover	13	21	22	18	15	18
• Other methods (e.g., take to dealer)	11	12	9	22	12	12

Methods of pesticide container disposal. Some interesting differences among the states in terms of how private applicators dispose of their empty pesticide containers can be seen in Exhibit 4.3-20. The most common practices reported, incineration (37%) and burial (34%), are especially prevalent in Nebraska (55% burn them, and 49% bury them) and lacking in Iowa (27% burn them, and 19% bury them). Iowa, on the other hand, has the highest percentage of growers who report rinsing their containers (36%), crushing or puncturing them (23%), and hauling them to a community landfill (28%). Iowa is also experimenting with charcoal disposal pits located on the farm. Less than 10% of the nonimpacted respondents in Georgia, Pennsylvania, and New York reported crushing or puncturing their containers, and less than 15% in Georgia, Nebraska, and Pennsylvania reported rinsing them.

Since Georgia and Pennsylvania also show the highest percentages of growers who take their containers to a private trash dump (23% and 19% respectively), it is reasonable to assume that the private applicators in these two states report less acceptable methods of pesticide container disposal than the private applicators in the other three states. However, responses of burning, burying and taking pesticide containers to a dump are generally considered good disposal methods in Nebraska. Nearly all city and village dumps in Nebraska are licensed for pesticide disposal. Farmers may not recognize the difference between landfill and dump, private, public, licensed, or unlicensed. All landfills are called dumps by farmers, and the confusion probably warrants more detailed follow-up during recertification.

Methods of pesticide and equipment storage. The final exhibit in this section of the report, Exhibit 4.3-21, shows the responses of nonimpacted growers when asked how they store their pesticides and equipment when not in use. More than three-quarters of these growers (77%) identified a special shed or area or building where they stored them, with the highest percentage appearing in New York (84%). About one-fourth (24%) reported washing and cleaning their equipment before storing it, again the highest percentage appearing in New York (28%). The percentage of private applicators in New York and Pennsylvania who

Exhibit 4.3-20

No Difference Respondents -- Methods of Container Disposal

Response Category	GEORGIA	NEW YORK	PENN.	NEBRASKA	IOWA	TOTAL
	(Percentage of Nonimpacted Respondents)					
• Burn them	31	35	41	55	27	37
• Bury them	34	36	35	49	19	34
• Rinse them	11	20	14	13	36	18
• Crush or puncture them	8	9	5	17	23	14
• Haul them to a landfill	29	28	11	11	28	22
• Take them to a dump	23	13	19	12	10	15
• Store them in a special place awaiting disposal	6	2	5	1	1	3
• Other methods (e.g., take to dealer, re-use them)	7	7	10	8	14	8

Exhibit 4.3-21
No Difference Respondents -- Methods of Pesticide Storage

Response Category	GEORGIA	NEW YORK	PENN.	NEBRASKA	IOWA	TOTAL
	(Percentage of Nonimpacted Respondents)					
• Keep them locked	16	18	18	9	9	14
• Keep them in special area/shed/building	79	84	78	71	74	77
• Keep them away from children/animals	12	6	9	13	11	10
• Wash/clean equipment before storing	24	28	20	25	24	24
• Store away from extreme heat	7	6	9	7	7	7
• Other methods (e.g., take to dealer)	7	5	4	11	10	8

reported locking up their pesticides and equipment (18%) was twice the corresponding percentage in Iowa and Nebraska (9%). While other responses were obtained such as keeping the pesticides away from children, animals, or extreme heat, and taking them to a dealer, the surprisingly low proportion of growers in each of the five states (but especially in Iowa and Nebraska) who reported locking up their pesticides indicates a need for continued emphasis on this important practice during recertification.

While it is difficult to summarize, in terms of level of acceptability, the current behavioral practices of those respondents who reported not being impacted by training, it is important to make an attempt to do this so that areas needing special emphasis during recertification in each state can be identified. The current practices reported by nonimpacted growers are summarized below for the eight behavioral areas investigated:

- Pesticide transportation: Adequate in all five states. Needs little emphasis during recertification.

- Clothing worn while mixing and loading: Less adequate in Georgia than in the other states; more adequate in New York than in the other states. Needs continual emphasis, particularly in Georgia.

- Clothing worn while spraying: Seems to be adequate in New York only, with Georgia again showing less impact in effecting appropriate changes in the wearing of protective gear while spraying. Needs even greater emphasis than clothing worn while mixing and loading toxic pesticides.

- Frequency of equipment calibration: Growers need to be motivated to calibrate more frequently for environmental and not just economic purposes. However, it should be kept in mind that some pesticide equipment does not need to be calibrated, and even after equipment is calibrated it should be rechecked to be sure that the appropriate amount of acreage is being sprayed for the amount of pesticide being used. New York and Pennsylvania growers generally report less frequent calibration than growers in the other three states.

- Methods of spray drift prevention: Adequate in all five states. Needs little emphasis during recertification among private pesticide applicators.

- Methods of handling leftovers: Probably needs continual emphasis in all five states; however, no conclusions can be reached concerning adequacy of behavior due to ambiguity in the responses (burial and closed container responses, especially) and the general lack of agreement as to acceptable methods.

- Methods of container disposal: Less adequate in Georgia and Pennsylvania than in the other three states. Needs emphasis during recertification, particularly concerning rinsing, puncturing, and dumping of containers and distinctions between sanitary landfills and private trash dumping.

- Methods of pesticide and equipment storage: Appears to be inadequate in all five states, more so in Iowa and Nebraska, and less so in New York. Needs continual emphasis during recertification.

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EVALUATION OF THE PRIVATE APPLICATOR PESTICIDE TRAINING AND CERTIFICATION PROGRAM: A FIVE-STATE STUDY

APPENDIX A: Georgia Evaluation Report

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Prepared by Abt Associates Inc. for the Environmental Protection Agency and the Council on Environmental Quality under Contract No. EQ9AC014, as amended. Opinions expressed herein are those of the Contractor and do not necessarily represent the official views of the sponsoring and participating federal and state agencies.

AN EQUAL OPPORTUNITY EMPLOYER

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APPENDIX A

GEORGIA EVALUATION REPORT

Training for private pesticide applicators began on a statewide basis in Georgia in 1977. By 1980, over 33,000 growers had been trained and certified as private pesticide applicators. One hundred and fifty-seven counties--each with one or more county agents--have delivered the training program, developed and supervised through the Cooperative Extension Service. In partnership with the Georgia Department of Agriculture, the state lead agency which serves as the regulatory agency, the Cooperative Extension Service estimates that 80% of all Georgia's growers will have been trained and certified by the end of 1981.

In the following section, we will describe relevant background characteristics of the study respondents in Georgia. In Section 2.0 we begin our analysis of the Georgia Private Pesticide Applicator Training and Certification Program. We will describe key characteristics of the training program and the overall assessment of the program as reported by study respondents. In subsequent subsections of Section 2.0 we will summarize perceived advantages and disadvantages of the program, plus grower assessment of individual training elements. This chapter concludes with grower assessment of the certification program, recertification program, and a summary of the overall training assessment and its correlation with specific background characteristics of the respondent population.

1.0 ANALYSIS OF BACKGROUND CHARACTERISTICS

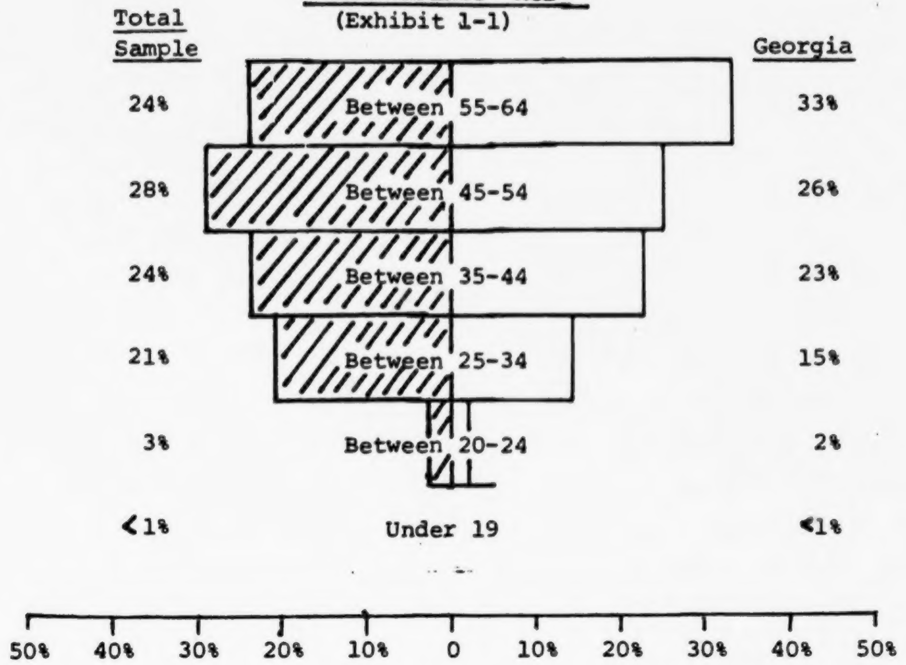
A total of 407 private pesticide applicators responded to the telephone questionnaire in Georgia. In general, the respondents in Georgia were least similar to the study sample as a whole in terms of background characteristics such as age and education. Exhibits 1-1 and 1-2 illustrate the age and education distributions of Georgia respondents.

Exactly one-third (33%) of the Georgia respondents were more than 55 years of age. This was the highest percentage in this age group of all five states in the study and substantially higher than the 24% from the study sample as a whole. Georgia also had the fewest young respondents. Only 18% reported that they were 34 years of age and under, compared with 24% of the study sample as a whole.

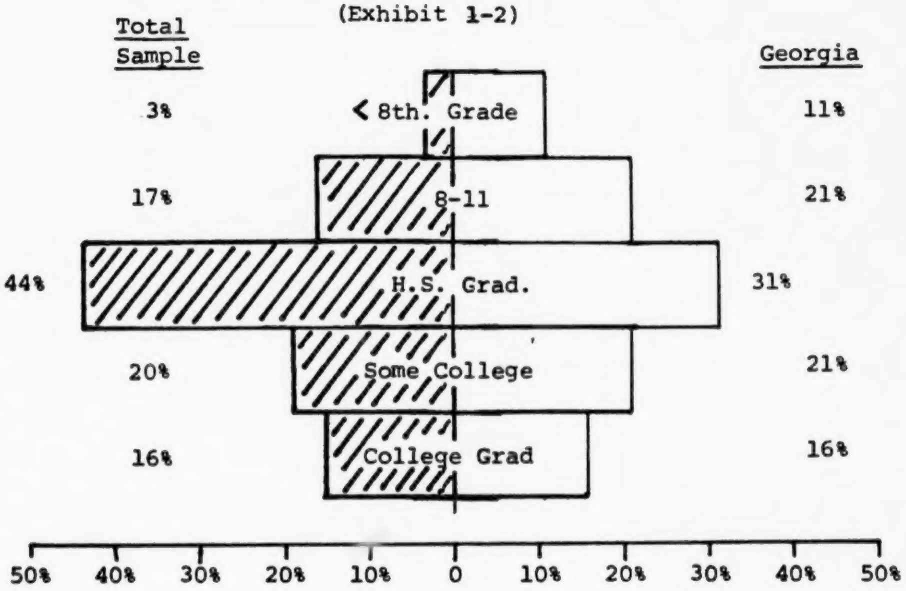
Georgia had significantly greater numbers of respondents who reported that they had less than a high school education. Almost a third (31%) in Georgia reported that they had not graduated from high school, compared with only one-fifth (20% for the study sample as a whole. On the other hand, 36% reported that they had some college or a college degree, exactly the same as the study sample as a whole. We will show in later sections of this analysis that neither age nor education correlates significantly with the reported impacts of training.

In terms of experience with pesticides, the Georgia respondents had somewhat more experience than the study sample as a whole. Exhibit 1-3 shows that 38% of all Georgia respondents reported having 21 years or more experience with pesticides, higher than any other state except New York which also reported 38% with 21 years or more of experience with pesticides. This compares with only 33% of the study sample as a whole with 21 years or more. Only 28% of the Georgia respondents reported having 10 years or less of experience with pesticides, also the lowest of any state except Nebraska, and lower than the 31% of the full study sample who reported 10 years of experience or less.

RESPONDENTS' AGE
(Exhibit 1-1)

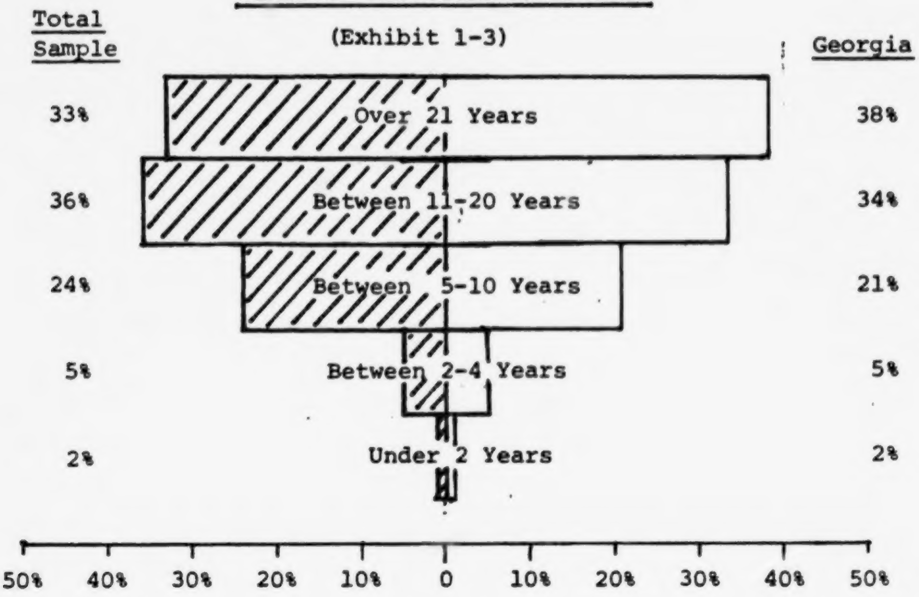


LAST YEAR OF SCHOOL COMPLETED
(Exhibit 1-2)



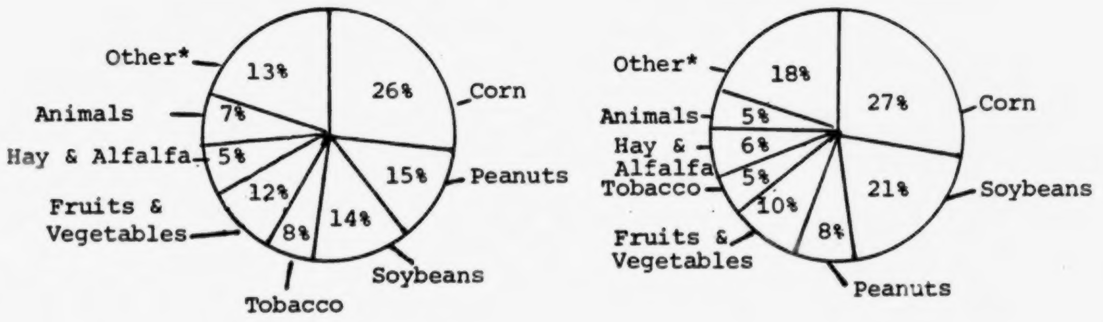
YEARS OF PESTICIDE EXPERIENCE

(Exhibit 1-3)



PRINCIPAL CROPS

(Exhibit 1-4)



Primary Principal Crop

Secondary Principal Crop

*Other includes: Cotton; wheat and other grains; flowers; and trees.

*Other includes: Cotton; wheat and other grains; flowers; and trees.

As shown in Exhibit 1-4, the principal crops in Georgia are the most diverse of any state in the study. The dominant primary crop was corn, as it was in all other states, but only 26% of the respondents in Georgia cited corn as the primary crop. Other primary crops included: peanuts (15%), soybeans (14%), fruits and vegtables (12%), and tobacco (8%). The distribution of secondary crops in Georgia was very similar to the distribution of primary crops. They included: corn (27%), soybeans (21%), fruits and vegetables (10%) and peanuts (8%). Other crops cited in Georgia include: animals; hay and alfalfa; cotton; wheat and other grains; flowers; and trees.

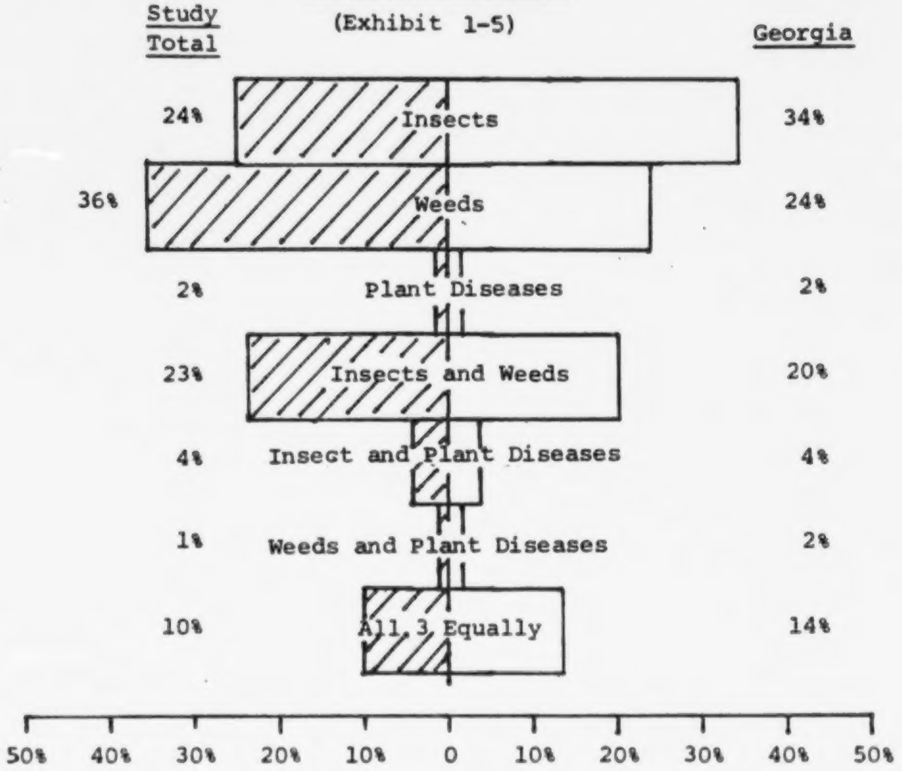
Given the diversity of crops in Georgia, and the climate of the Southeastern United States, it is not surprising that the most common type of pest reported by Georgia respondents was insects (34%) followed by weeds (24%), shown in Exhibit 1-5. Only 2% of the Georgia respondents mentioned plant diseases as a principal pest. Moreover, 20% mentioned both insects and weeds equally, and an additional 14% mentioned all 3--insects, weeds, and plant diseases--equally.

Some common pesticides used by private applicators in Georgia are Methemyl, Paraquat (herbicide), Parathion, and Azinphos Methyl. All four are restricted. For corn-related pests, Parathion, an extremely toxic pesticide, and Monocrotophos, a less toxic pesticide, are commonly used in Georgia.

Georgia growers were also dissimilar from the study sample as a whole in terms of the numbers of acres farmed. Almost half of the Georgia respondents (46%) reported a farm size of 100 acres or less, more than any other study state, and compared with only 28% of the study sample as a whole. Unlike the Northeastern states, however, Georgia showed a comparatively large number of respondents who reported size of farm in excess of 500 acres. A total of 18% of Georgia growers reported farms of this size, compared with 24% of the study sample as a whole, but only an average 12% for the two Northeastern study states. The distribution of size of farm in Georgia is summarized graphically in Exhibit 1-6.

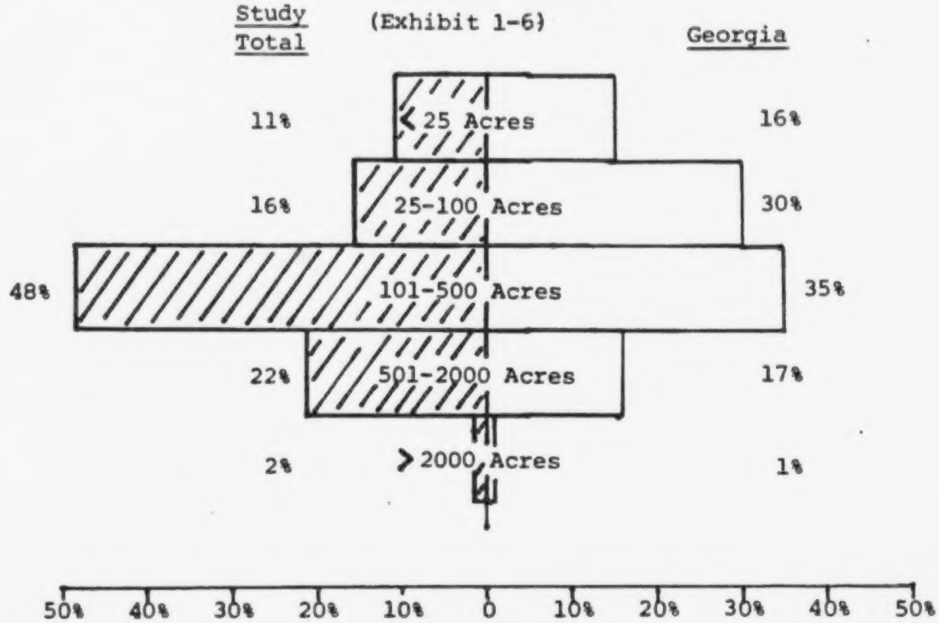
PRINCIPAL PESTS

(Exhibit 1-5)



ACRES FARMED

(Exhibit 1-6)



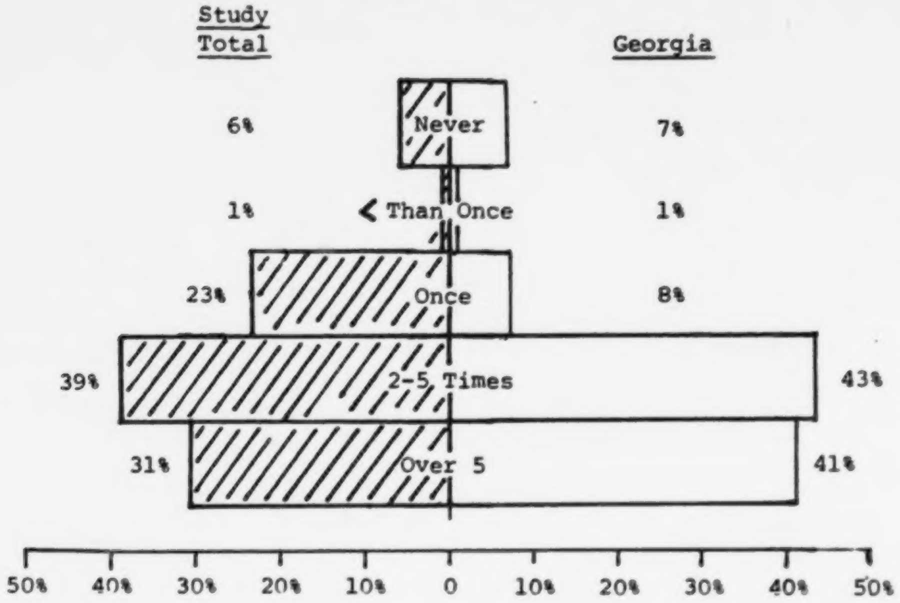
Because of the nature of the crop-pest problem in Georgia, growers there report application of pesticide slightly more often than those in almost any other state. A total of 85% of the growers in Georgia report applying pesticides twice a year or more, compared with 70% in the study sample as a whole. Only 10% of the Georgia growers apply pesticides only once a year, as shown in Exhibit 1-7, compared with 23% of the study sample as a whole.

The combination of small farms and more frequent application of pesticides leads to a distribution of pesticide expenditures that is concentrated on the extreme ends of the scale, as shown in Exhibit 1-8. On the one hand, more Georgia respondents reported spending under $1000 (55%) than did the study sample as a whole (43%). But at the same time, more Georgia respondents reported spending more than $5000 (21%) than did the study sample as a whole (18%). Only one-quarter of the Georgia respondents reported pesticide expenditures in the middle range, between $1000 and $5000, compared with more than one-third (39%) of the study sample as a whole.

In summary, the Georgia respondent group was the most dissimilar from the study sample as a whole. These differences could be summarized as follows: Georgia respondents were older, less educated, more experienced with pesticides (perhaps because of their age), have smaller farms, apply pesticides more frequently, and spend both more and less on pesticides than the full study sample. In the following section, the Georgia Private Pesticide Applicator Training and Certification Program is described and analyzed in terms of training program characteristics and overall assessment of the program by the growers.

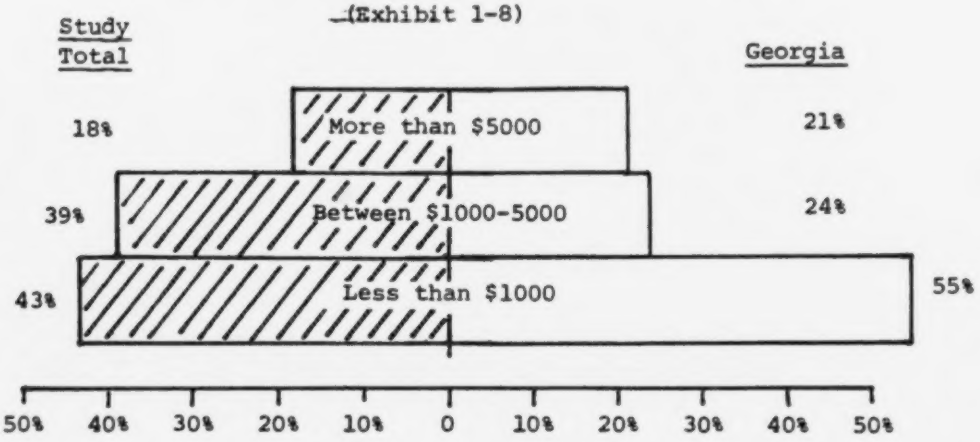
PESTICIDE APPLICATIONS PER YEAR

(Exhibit 1-7)



PESTICIDE EXPENDITURES LAST YEAR

(Exhibit 1-8)



2.0 ANALYSIS OF TRAINING PROGRAM CHARACTERISTICS

2.1 Program Description and Overall Assessment

Development of the Georgia program began in 1975, when a State Steering Committee was formed to make policy recommendations and to adapt and develop training materials so that they would be appropriate to the unique needs of Georgia. The Steering Committee was composed of Cooperative Extension Service specialists (entomologists, plant pathologists, agronomist, and engineers) and officials from the State Department of Agriculture. The Committee decided to use the Colorado Slide Tape Series, the EPA Core Manual, plus its own exercise which stresses the importance of understanding pesticide labels.

In terms of presentation, the training is conducted by county agents who combine lecture and audio-visual presentation using the Colorado Slide Tape Series. The other training materials used are the manual and Georgia's "training workbook" on pesticide labels. The workbook was adapted from an EPA Training Bulletin and consists of twenty questions which are reviewed by the trainee along with the sample label. Included are several questions on calibration. The county agent administering the session "works through" the booklet question-by-question with the trainees. Completion of the label workbook is required for certification.

Few variations of the training program exist in the state. EPA's "Programmed Instruction" is offered as an alternative to the training session, but only 3% of the Georgia respondents reported having used this method. The "Programmed Instruction" course is a home study program which covers the same information contained in the EPA Core Manual. The self-study program requires the trainee to take a pretest, read and complete questions based on the text, and take a posttest for each chapter. Upon completion of the self-study manual, the applicator may present it to his county agent to verify that it has been thoroughly completed. The county agent then sends a portion of the completed manual along with the certification application to the State Department of Agriculture for certification.

The Cooperative Extension Service (CES) and the Department of Agriculture (DOA) are the state agencies responsible for administering and coordinating training and certification. CES is responsible for organizing and administering training sessions, a process that is non-regulatory. DOA mails the appropriate certificates to the growers once they have completed the required training. This procedure has taken on increased significance since 1979 when the state decided to increase enforcement of the law requiring all buyers of restricted-use pesticides to present their certificate at the time of purchase.

CES divides the state into five major districts (north, central, northcentral, southeast, and southwest). Each of the state's 159 counties is allocated to one of these districts for administrative purposes. Each district has a District Agent who coordinates organization and information among the county agents in his district. The District Agents, in turn, communicate frequently with the state's training coordinator at the University of Georgia at Athens.

DOA is headquartered in Atlanta and operates from six regional offices throughout the state. The regions of DOA are not coterminous with the CES districts. The DOA Pesticide Division is the state lead agency for pesticide training and certification, and the agency responsible for issuing certificates and maintaining records on certification.

There is an active recertification program of private pesticide applicators in Georgia.

Source of Pesticide Assistance.

Generally, growers have available a number of formal and informal sources of information regarding pesticide selection and use, the private applicator training program being the most certain source. Beyond training, however, growers have on-going needs for assistance. To determine where growers get assistance, each respondent was asked to identify to whom he would be most likely to go for information about pesticides (specifically, if not sure about how to use a pesticide or which pesticide to use). This open-ended question--responses were recorded as provided--was coded into the following categories:

- county agent
- neighbor or relative:
- chemical dealer, supplier, or company sales respresentative;
- state department or agriculture official;
- vocational agricultural teacher;
- farm magazines and publications; and
- other.

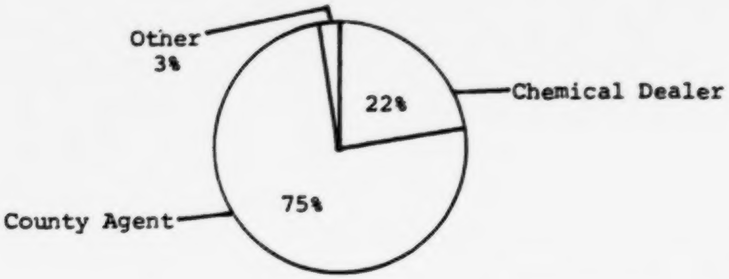
Exhibit 2.1 shows that 75% of the respondents in Georgia indicated that they would go to their county agent. This is 50% higher than the study sample as a whole where only 50% indicated that the county agent was the person to whom they were most likely to go for assistance. This high proportion of Georgia respondents who report turning to the county agent probably reflects: (1) the strength of the extension service and the large number of counties in Georgia, and (2) the comparative weakness of the chemical dealer network in Georgia and eastern states generally. This high reliance on the county agent for information suggests that there may be a process whereby the pesticide training program, also administered by the county agents, is reinforced by regular informal communication between growers and the county agents.

Overall Worth of Training.

One potential indicator of the degree of satisfaction that the grower has with the effectiveness of training sessions in providing the type of information which the grower needs is his overall rating of training. Exhibit 2-2 compares the rating of Georgia's growers with the overall study sample on the issue of how worthwhile the growers found the state private applicator training program to be. A majority (61%) of the Georgia respondents found the program to be "very worthwhile," compared with only 47% of the respondents in the study sample as a whole. Indeed, Georgia's percentage of respondents reporting that the program was "very worthwhile" was the highest of any state in the survey. Only 12% reported that the program was "not very worthwhile," almost exactly the same as the study sample as a whole. In general, Georgia respondents reported reactions at the extreme ends of the scale. Only one-quarter found that the program was "somewhat worthwhile."

SOURCE OF PESTICIDE ASSISTANCE

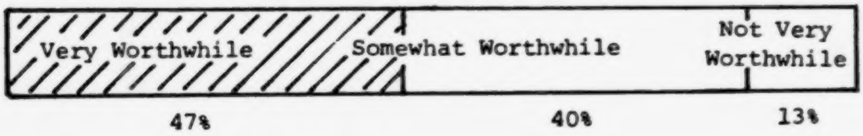
(Exhibit 2-1)



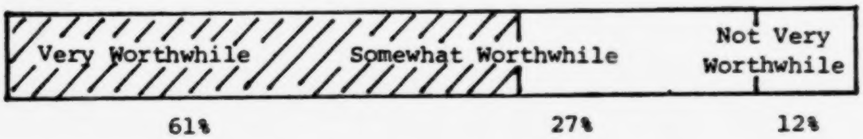
PERCEIVED WORTH OF TRAINING

(Exhibit 2-2)

Study Total:



Georgia:



2.2 Advantages and Disadvantages of the Program

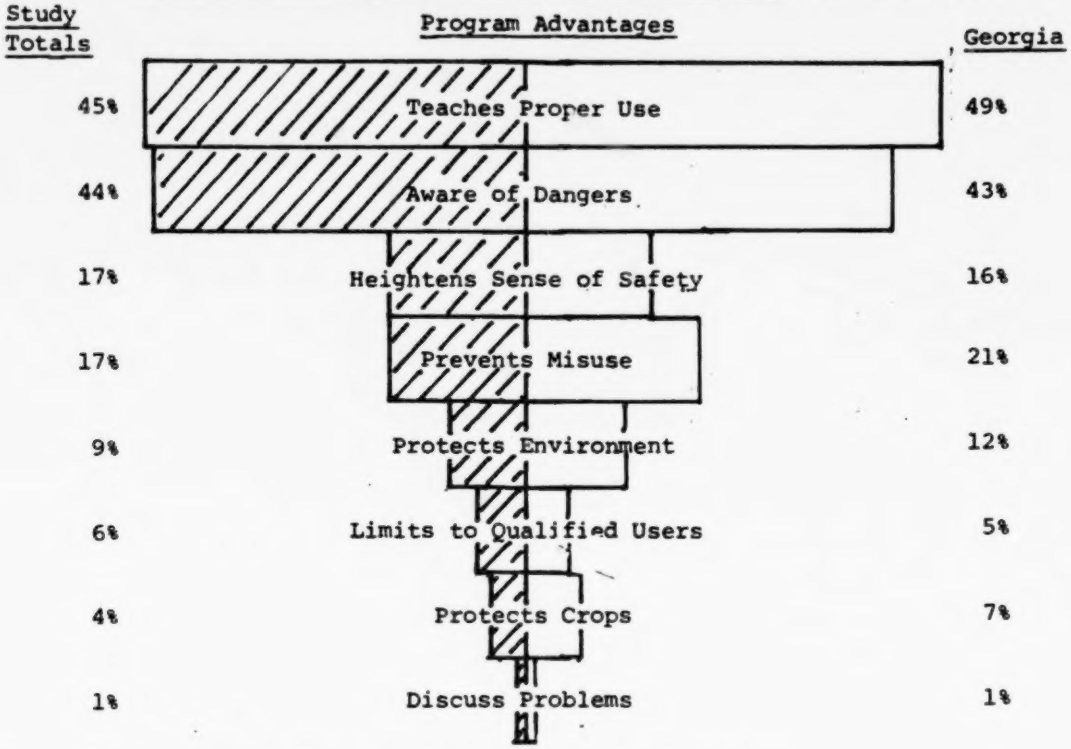
Respondents were asked to describe what they thought the advantages of having a state private applicator training and certification program were; then they were asked to describe perceived disadvantages. The open-ended nature of the question tends to strengthen the importance of each of the responses to this series of questions, a display of which is provided in Exhibit 2-3.

In terms of program advantages, almost half (49%) of the Georgia respondents noted that the program taught the proper use of chemicals. This was a higher percentage of respondents than in any other state, and higher than the study sample as a whole (45%). It is possible that Georgia's emphasis on labelling in its training program may be associated with the high percentage of respondents citing this advantage more often than any other. Other important advantages, as measured by the frequency of their mention by Georgia respondents, were: creates an awareness of the dangers of pesticide use (43%), prevent misuse of pesticides (21%), and makes you aware of safety precautions to take when using pesticides (16%).

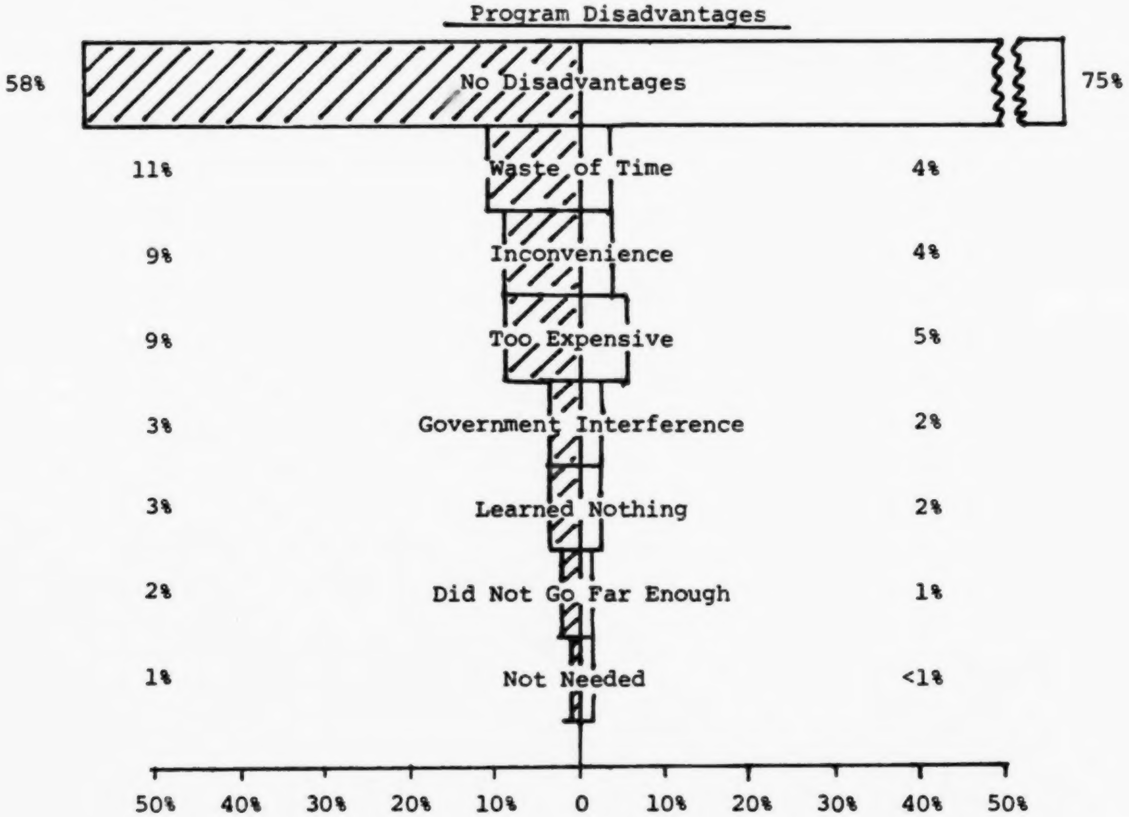
In terms of disadvantages, three-quarters of the Georgia respondents (exactly 75%) cited "none." This was substantially higher than the 58% of the study sample as a whole who cited no disadvantages, and it is consistent with Georgia's generally more favorable perception of the program. Only a few respondents in Georgia cited any disadvantages. The leading disadvantages, in terms of number of respondents mentioning them, include: "too expensive" (5%), "waste of time" (4%), and "inconvenience" (4%). These also were the leading disadvantages cited by the study sample as a whole.

These favorable responses from Georgia growers suggest that participants in the Georgia program needed the information about pesticides that was provided and that they found this information to be useful.

ADVANTAGES AND DISADVANTAGES OF THE STATE PRIVATE APPLICATOR TRAINING AND CERTIFICATION PROGRAM (Exhibit 2-3)*



*(Note: Percentages in this exhibit need not total 100%)



2.3 Assessment of Individual Training Elements

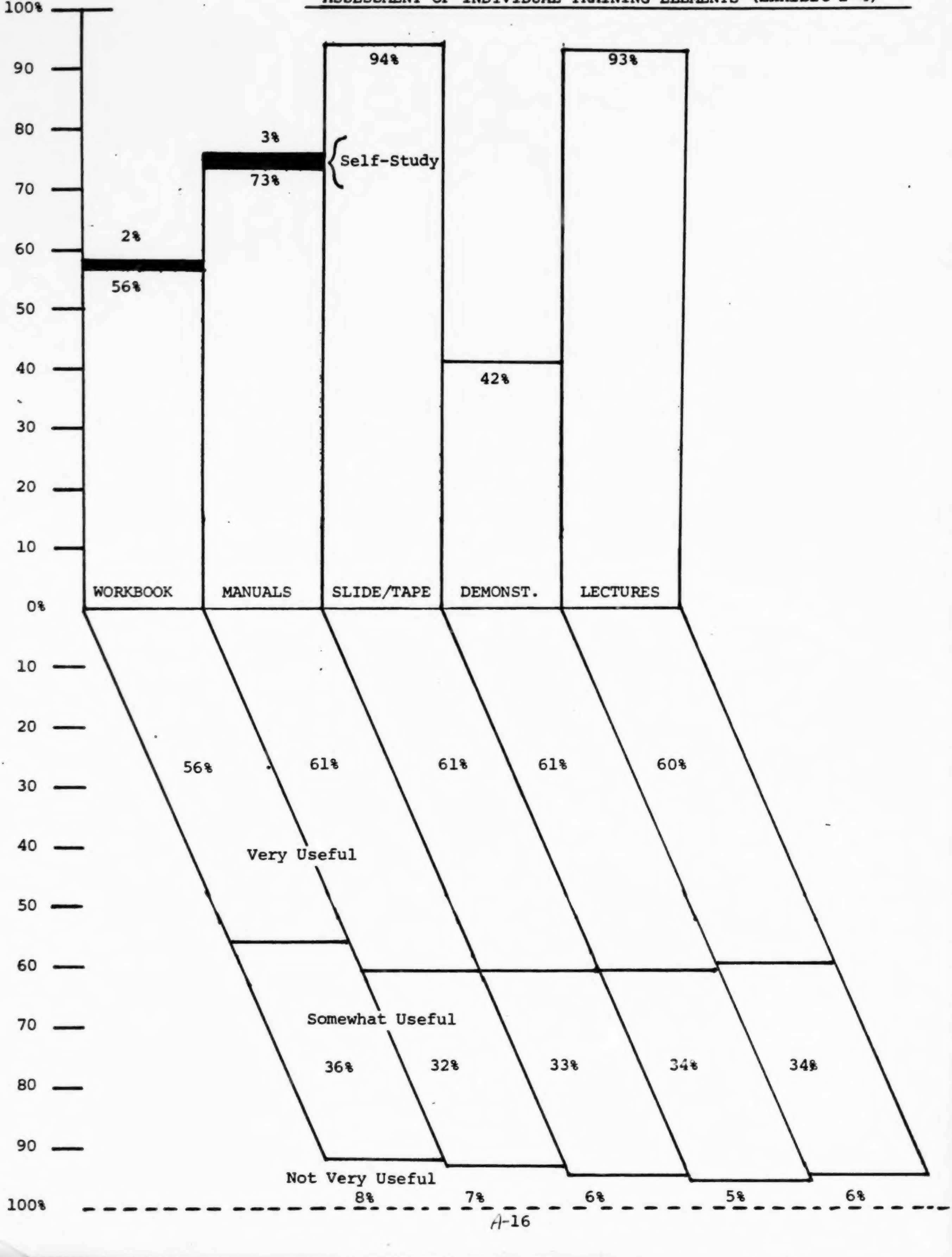
In order to determine whether or not particular aspects of the training program were perceived by the grower as having greater or lesser value than others, respondents were asked to indicate whether or not their training sessions included any of the following items: slide/ tape series; film or videotape; demonstration program; lecture; training manual; or workbook. For each item which the grower indicated that he had during training, he was asked to indicate whether he found the particular item to be "very useful," "somewhat useful," or "not very useful." An identical set of questions (omitting demonstrations and lectures) was asked of those who indicated that they received their training via self-study methods. Since the Georgia program does not include a film, the analysis which follows focuses only on the five other training elements.

Exhibit 2-4 displays these five training elements. The bars at the top shows the total percentage of respondents who indicated that they received each method, whether by training session or by self-study. The bars on the bottom of Exhibit 2-4 show the usefulness ratings for each of the methods reported received and assessed by the growers.

Like most other states, the lecture was the method most often reported by Georgia respondents (93%), followed closely by the slide/tape series. The least common training method was the demonstration, but the percentage of respondents indicating the use of this method was higher in Georgia than in any other state, and higher than the full study sample (38%). The percentage of Georgia respondents indicating the use of a manual (73%) was lower than that for the full study sample (89%) as was the percentage of Georgia respondents indicating the use of a manual (56% compared with 74% for the study sample as a whole).

In terms of perceived usefulness, there is hardly any difference among the five training elements. Approximately 60% of all respondents who had received a training element reported that it was "very useful." The lowest percentage in Georgia was that for the workbook, presumably referring to the special Georgia workbook on pesticide labels. Even

ASSESSMENT OF INDIVIDUAL TRAINING ELEMENTS (Exhibit 2-4)



though the percentage reporting that this training element was "very useful" was lower than the other four training elements, it is important to note that 54% of the respondents who used it--over half--nevertheless reported that it was "very useful." The absence of significant variation between the five training elements, in terms of perceived usefulness, limits our ability to comment critically on the individual components of the training package.

2.4 Initial Certification and Assessment of Certification

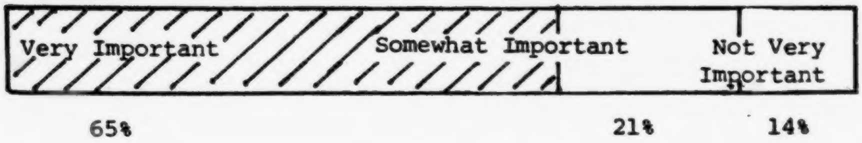
In order to distinguish the possible differences between the overall perceived value of training from the overall perceived importance of requiring certification for private pesticide applicators, growers were asked to indicate how important they felt it was for Georgia to have a restricted pesticide certification program for private applicators, using a rating scale of "very important," "somewhat important," and "not very important."

For purposes of comparison, Exhibit 2-5 shows the growers' ratings of the importance of certification alongside the growers' overall ratings of the worth of training. Over three-fifths (61%) of the respondents indicated that the training was very worthwhile, and a slightly higher number (65%) indicated that certification was very important. As in most other states, the percentages of respondents with a positive response to the perceived importance of certification is slightly higher than the percentage with a positive response to the perceived worth of training. At the same time, however, the percentage of Georgia respondents who said that the training was "not very worthwhile" was smaller than the percentage of Georgia respondents who said that the certification program was "not very important." This, too, is consistent with the distribution of responses in the full study sample.

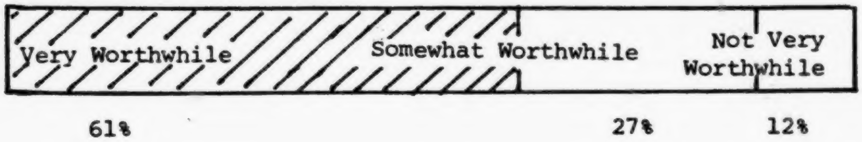
Exhibit 2-6 shows the years in which Georgia growers were initially certified along with the years in which this initial certification expires. Almost one-quarter (22%) of Georgia respondents reported that they did not know their year of initial certification, and 36% said they did not know when their certification expires--percentages

PERCEIVED IMPORTANCE OF CERTIFICATION AND OVERALL WORTH OF TRAINING (Exhibit 2-5)

IMPORTANCE OF CERTIFICATION



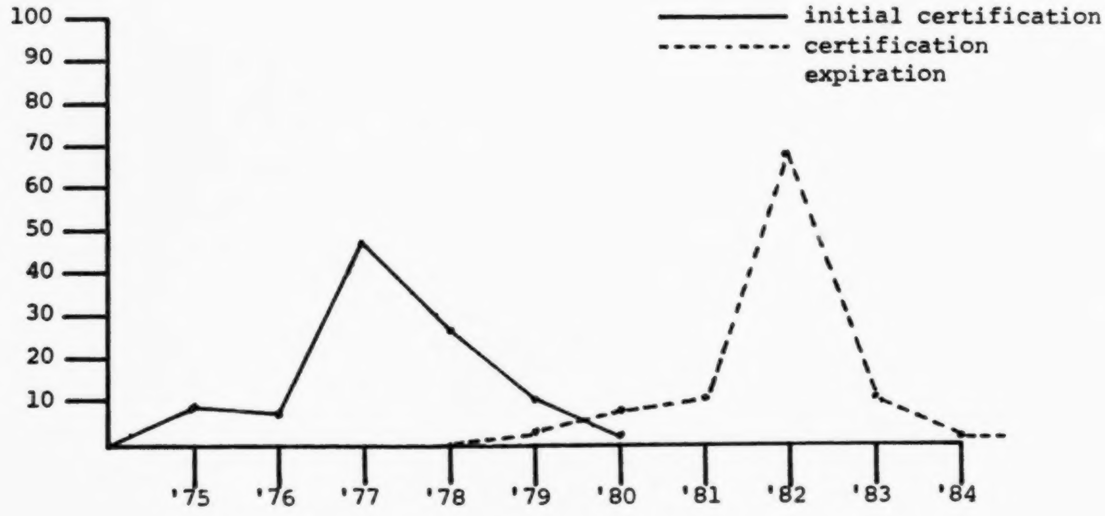
OVERALL WORTH OF TRAINING



(Exhibit 2-6)

YEAR OF INITIAL CERTIFICATION	
1975:	9%
1976:	8%
1977:	46%
1978:	27%
1979:	10%
1980:	1%

YEAR OF CERTIFICATION EXPIRATION	
1978:	<1%
1979:	2%
1980:	8%
1981:	10%
1982:	67%
1983:	10%
1984:	1%
1985:	1%



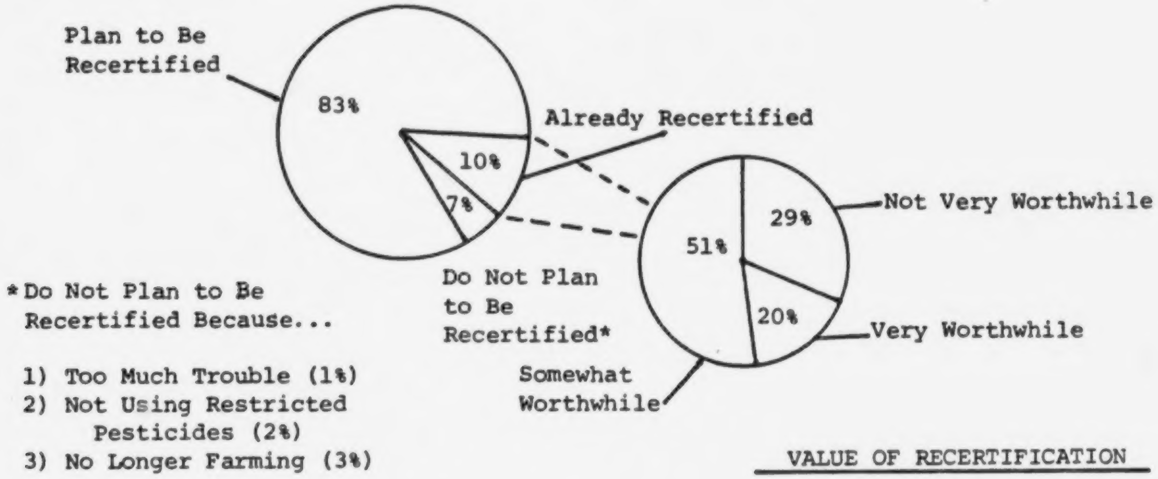
that are about average for the study sample as a whole. Excluding those who didn't know the dates, Exhibit 2-6 reports adjusted frequencies of responses by year. As one might expect, the largest percentage of Georgia respondents reported that they were certified in 1977, the first year of operation for the training program. Another 17% reported 1978. It appears that most growers were certified for four or five years, since 67% report that their certification expires in 1982.

2.5 Recertification Status and Assessment of Recertification

Growers were asked to indicate whether or not they planned to become recertified. Exhibit 2-7 indicates that the vast majority of Georgia respondents, 83%, say that they plan to be recertified. This is the highest percentage of any state, and it is well above the percentage for the full study sample, 58%. Only 7% of the Georgia respondents say that they do not plan to be recertified, a slightly lower percentage than the study sample as a whole which reported 9%. Of those who reported they did not plan to be recertified, the most frequently-cited reasons in Georgia were: not using restricted pesticides and no longer farming.

Ten percent of the respondents in Georgia reported that they were already recertified. Of those who reported that they were already recertified, only 29% reported that the recertification was "very worthwhile," and 20% reported that it was "not very worthwhile." These are decidedly more negative perceptions of training worth than those expressed by respondents in general about the initial training program and the certification program. This reversal of perceived worth is consistent with the pattern established by the study sample as a whole. One would need more information on the reported recertified growers, however, before further interpretation is possible.

RECERTIFICATION PLANS (Exhibit 2-7)



VALUE OF RECERTIFICATION

*Do Not Plan to Be Recertified Because...

1) Too Much Trouble (1%)
2) Not Using Restricted Pesticides (2%)
3) No Longer Farming (3%)

2.6 Training Assessment by Background Characteristics

In order to determine whether or not particular types of respondents reported training being more or less worthwhile than other types of respondents, the background characteristics of Georgia growers were examined in light of their overall assessment of training worth. Spearman nonparametric correlation coefficients were computed, and the coefficients for both Georgia and the study sample as a whole are displayed below. Only those coefficients which were statistically significant at the 95% confidence level are reported.

Background Characteristic	Georgia	Study Total
● number of acres farmed	-.18	-.14
● last year of school completed	-.05	-.05
● age	.05	.08
● years of pesticide experience	-.03	-.03
● spent on pesticides last year	-.15	-.13
● training or self-study	a	a

[a] Indicates correlation not statistically significant at the .05 level.

In general, both the sign and magnitude of the correlation coefficients for Georgia respondents were the same as those reported by the study sample as a whole. These correlations could be summarized as follows: the type of respondent who rated the training as most worthwhile tended to be older, with less formal education, with smaller farms, with less pesticide experience, and with lower expenditures on pesticides. The correlation which indicates that those who spent less on pesticides last year, both in Georgia and in the study sample as a whole, tended to rate the training as more worthwhile, is not surprising given the strong positive association (r=.55) between pesticide expenditures and acres farmed (i.e., the fewer the acres, the less the expenditures on pesticides). No significant relationship exists between those receiving training by session or self-study and the overall assessment of training worth, either in Georgia or in the whole study sample.

Of even more interest than these correlations between background characteristics and perceived training worth are the relationships between these same background characteristics and behavioral impacts. The analysis of reported behavioral impacts for Georgia respondents is the subject of the next section of this chapter.

3.0 ANALYSIS OF BEHAVIORAL CHARACTERISTICS

For the percent of all respondents in Georgia who reported using pesticides within the last three years to control insects, weeds, or plant diseases, a series of questions was asked to determine the potential perceived impacts of training in eleven pesticide-related grower behaviors:

1. Methods of pest identification,
2. Amount of crop damage allowed,
3. Methods of pesticide transportation,
4. Clothing worn while mixing and loading,
5. Clothing worn while spraying,
6. Frequency of equipment calibration,
7. Methods of spray drift prevention,
8. Methods of handling spills on skin or clothing,
9. Methods of handling leftovers,
10. Methods of pesticide container disposal, and
11. Methods of pesticide and equipment storage.

These eleven behavioral impact areas correspond to activities that are stressed in the EPA core manual which is the basis of the Georgia training program. Topics receiving special emphasis in Georgia, according to reports from state officials, are labels and calibration. Indeed, labels are particularly emphasized in the special Georgia workbook entitled "Understanding Labels."

The design of the questionnaire enabled the respondent to answer "yes" or "no" to a question that asked whether he or she had changed his/her behavior in each of the eleven impact areas. If the respondent answered "yes," a follow-up question asked the respondent to specify the type of change in behavior. For those respondents who answered "no," a follow-up question was added for eight of the impact areas to determine the respondent's behavior if not impacted.

3.1 Reported Behavioral Impacts

One way of obtaining an overview of the extent to which Georgia respondents changed their behavior subsequent to training is to consider the number of behavioral impact areas where changes were reported. Exhibit 3-1 shows the number of impact areas where changes were reported by the Georgia respondents and compares this number to the study sample as a whole. (It is important to keep in mind that these frequencies refer to behavioral areas, and that within each area there may be one or more specific types of behavior that were influenced by training.

As can be seen from Exhibit 3-1, 79% of Georgia's respondents and 76% of the total sample of respondents reported changing their behavior in at least one impact area; about one-quarter reported being affected in five or more areas. When compared with the study sample as a whole, Georgia respondents reported substantially more impact areas affected than the average.

Another method for comparing the overall results from Georgia with those of the study sample as a whole is to examine the percentage of respondents answering "yes" to questions about changed behavior since training for each of the impact areas. These are shown in Exhibit 3-2. As shown in that exhibit, Georgia respondents reported behavioral change subsequent to training more often than the five state average in all eleven of the impact areas. This exhibit also shows that the pattern of Georgia responses is similar to the pattern for the study sample as a whole, i.e., the impact areas with the highest number of positive responses are clothing worn while mixing and loading, handling spills, and proper disposal of pesticide containers. Similarly, the impact areas with the fewest positive responses are pest identification, crop damage allowed, and proper procedures for transportation of pesticides. Each of the eleven behavioral impact areas will be discussed individually below.

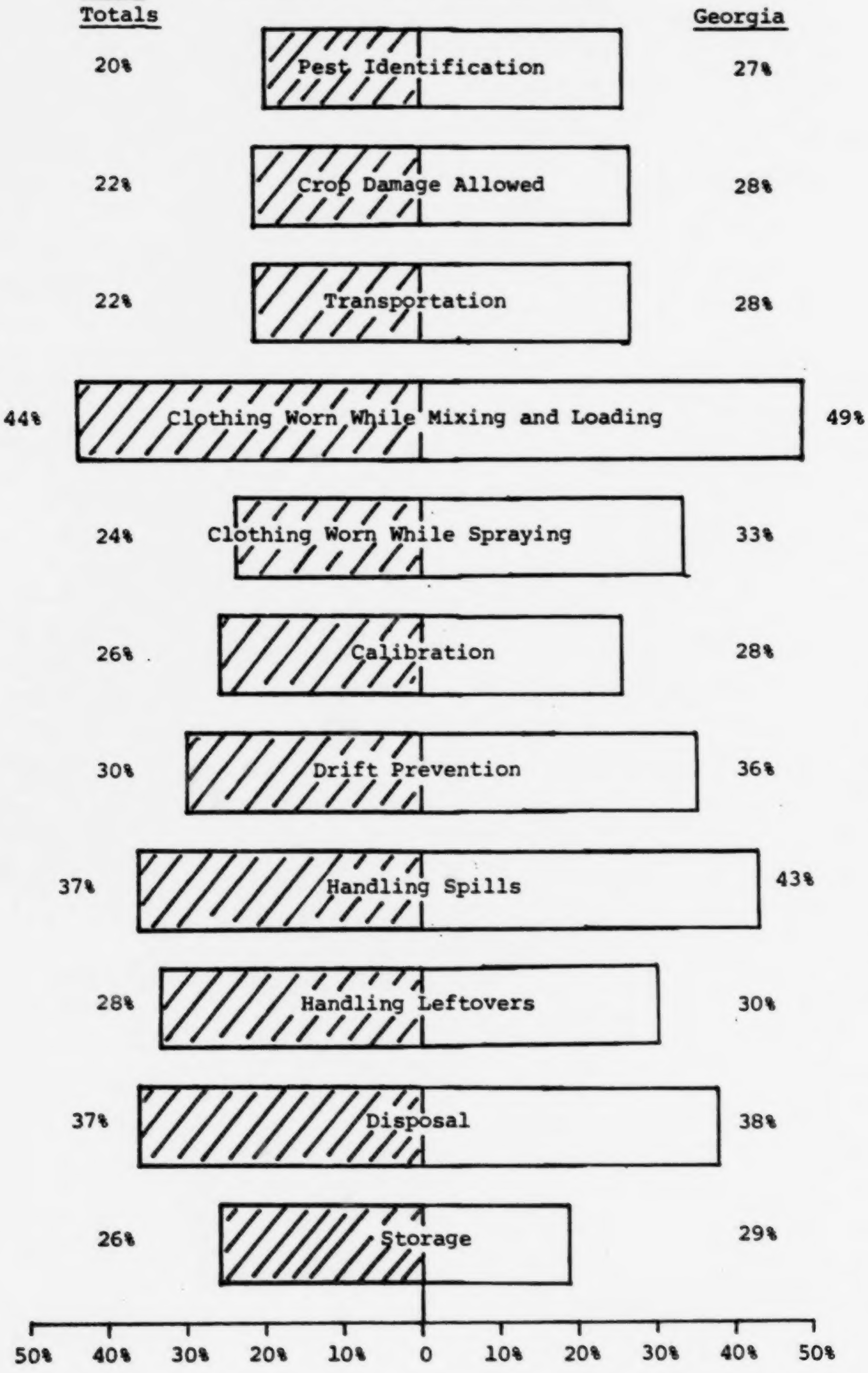
Exhibit 3-1

Number of Reported Behavioral Areas Impacted

Number of Behavioral Areas Impacted	Georgia		Study Total	
	Relative Frequency	Cumulative Frequency	Relative Frequency	Cumulative Frequency
0	21	21	24%	24%
1	10	31	13	37
2	11	42	11	48
3	12	54	11	59
4	10	64	10	69
5	11	75	9	78
6	7	82	7	85
7	6	88	5	90
8	4	92	4	94
9	3	95	3	97
10	2	97	2	99
11	3	100	1	100

Exhibit 3-2

PERCEIVED IMPACTS OF TRAINING



3.1.1 Pest Identification and Crop Damage Allowed

Unlike some states like Iowa, where the training sessions include demonstrations on the subject of pest identification, this is not a topic of special emphasis in Georgia. Nevertheless, Georgia respondents indicated that 27% had changed behavior in this area after training--the highest percentage of any state. Those respondents who answered "yes" to the question of whether there were any differences after training were then asked to specify differences. The responses from Georgia are listed below. No single changed behavior is dominant, which is consistent with the pattern across all states.

Pest Identification

Study Total: 20%
Georgia Respondents: 27%

better informed/better identification	5%
closer inspection of the pest	4%
check with local county agent	5%
better pest/pesticide matching	4%
other differences (e.g., use pest management program, more judicious spraying)	6%

The growers were next asked whether or not they perceived any differences since training in the amount of crop damage they allowed (before spraying) in situations where they had not planned on using pesticides. As shown in Exhibit 3-1, affirmative responses in this area were about the same as those for pest identification--both for Georgia and for the study area as a whole. Twenty-eight percent of the Georgia respondents answered affirmatively. When asked about specific differences in behavior since training, Georgia respondents listed the following:

Crop Damage Allowed

Study Total: 22%
Georgia Respondents: 28%

allow more damage	8%
allow less damage	7%
other differences (e.g., greater awareness or concern about when to apply pesticides)	11%

Again, Georgia was higher than all other states with respect to positive responses, and although it appears that nearly as many respondents said they would allow less damage as said they would allow more, the 11% who expressed a greater awareness or concern about applying pesticides probably tended to allow more crop damage as a result.

3.1.2 Pesticide Transportation

Twenty-eight percent of the Georgia respondents reported some change in behavior since training. Again, Georgia had the highest number of positive responses, and Georgia's percentage of positive responses was substantially above the study sample as a whole (22%). The reported types of changed behavior are listed below. It is interesting to note that Georgia was the only state where a specific difference in behavior related to transportation ("keep away from driver"), rather than being "more careful in general," was cited as the primary difference since training in the method of transporting pesticides. All of the other states recorded the highest number of positive responses for "more careful in general."

Transportation

Study Total: 22%
Georgia Respondents: 28%

more careful in general	8%
keep away from driver (in truck bed or trunk)	10%
keep in closed container	7%
other differences (e.g., have pesticides delivered, separate herbicides/insecticides, keep away from children and animals)	6%

3.1.3 Clothing and Protective Gear

The largest number of positive responses for any impact area, both for Georgia and for the full study sample, came in the area of clothing and protective gear worn while mixing and loading pesticides which have a skull and crossbones symbol on the label. Almost half (49%) of the Georgia respondents reported that their behavior in this area had changed, more than the study sample as a whole (44%). Georgia respondents also had a higher number of specific behavioral changes that received positive responses from 10% or more of the respondents than any other state except New York (Georgia had four such specific changes; New York had five). The most common change in clothing worn since training, both for Georgia and for the study sample as a whole, was the addition of waterproof or rubber gloves when mixing or loading pesticides. Other specific changes are listed below. The changes in Georgia in this behavioral impact area are not only higher than other states, but they are significant also because of the climate in Georgia which constitutes a barrier to any change of behavior in the clothing area.

Clothing Worn While Mixing and Loading

Study Total: 44%
Georgia Respondents: 49%

waterproof gloves	36%
waterproof boots	6%
long-sleeved shirt	12%
long trousers	2%
goggles or glasses	14%
respirator or filter mask	9%
dust mask	18%
hat	4%
coveralls	5%
raincoat or rainsuit	8%
other differences	2%

One-third of Georgia respondents reported that there had been some behavioral change since training in the area of clothing worn while spraying toxic pesticides. Again, Georgia's number of positive responses was higher than any other state, and Georgia was substantially higher than the study sample as a whole. For three of the specific response categories--waterproof gloves, long sleeved shirt, and dust mask--more than 10% of Georgia's respondents indicated that a change in behavior had occurred subsequent to training. This was a larger number of specific types of change (with 10% or more respondents indicating a change) than any other state. Details on specific changes in Georgia are found in the following tables.

Clothing Worn While Spraying

Study Total: 24%
Georgia Respondents: 33%

waterproof gloves	15%
waterproof boots	4%
long-sleeved shirt	12%
long trousers	4%
goggles or glasses	9%
respirator or filter mask	8%
dust mask	12%
hat	4%
coveralls	5%
raincoat or rainsuit	8%
other differences	2%

Some of the change in clothing worn--both during mixing and loading and also during application (spraying)--may be attributed to the emphasis in Georgia on understanding labels. As the reader will recall from Section 2.1, there is a special workbook in Georgia titled "Understanding Labels."

3.1.4 Equipment Calibration

Twenty-eight percent of the Georgia respondents indicated some change in this impact area after training. This was slightly higher than the study sample as a whole, but it was not as high as the reported changes in Nebraska. Georgia, like the other states, reported that their training emphasized calibration, but only Nebraska reporting having a special exercise to teach proper calibration techniques. Specific types of behavioral change are noted in the table below. No single change was dominant in Georgia or in the study sample as a whole, but the impacts clearly appear to be in terms of methods rather than frequency of calibration.

Calibration

Study Total: 26%
Georgia Respondents: 28%

calibrate more carefully	9%
calibrate more often	2%
measure pesticide more carefully	6%
follow instructions more closely	4%
other differences	8%

3.1.5 Drift Prevention

Thirty-six percent of the Georgia respondents reported some change in the impact area of drift prevention subsequent to training. This was higher than the study sample as a whole; and again, Georgia was the highest of the five states in the study. The single type of changed behavior that was most common, both in Georgia and the study sample as a whole, was "spray when the wind is low." Other specific types of changes are found in the table below.

Drift Prevention

Study Total:	30%
Georgia Respondents:	36%

spray when wind is low	26%
spray by wind direction	9%
spray at cooler times	2%
use lower pressure	3%
use larger nozzle opening	2%
use a drift control agent	2%
spray closer to the ground	3%
other differences	7%

3.1.6 Handling Pesticide Spills and Leftovers

Forty-three percent of the Georgia respondents indicated that they had changed their behavior since training in the area of handling spills. As in most other impact areas, Georgia had the highest percentage of positive responses in any state (except for New York, which also had 43%), and the percentage in Georgia was higher than for the study sample as a whole. Three specific types of changed behavior were dominant in the Georgia responses: wash more quickly (15%), wash more thoroughly (20%), and remove clothing (17%). These specific changes were also dominant in the study sample as a whole. For a summary of the specific responses of the Georgia respondents in this impact area, see the table below.

Handling Spills

Study Total:	37%
Georgia Respondents:	43%

wash more quickly	15%
wash more thoroughly	20%
remove clothing	17%
more careful in general	3%
more likely to read label	2%
other differences	3%

Thirty percent of the Georgia respondents indicated some change in their behavior in the impact area of handling leftovers. Like the area of handling spills, Georgia tied New York for the highest number of positive responses, and the responses in Georgia were slightly higher than the study sample as a whole (28%). The dominant single behavior change in this area for Georgia respondents was "store in a closed container" (12%). For other specific changes see the table below.

Handling Leftovers

Study Total: 28%
Georgia Respondents: 30%

drain it/bury in ground	5%
leave it in applicator	0%
apply it to another field	0%
continue spraying until applicator is empty	1%
store in closed container	12%
don't have any leftover	2%
other differences	6%

3.1.7 Pesticide Disposal and Storage

Thirty-eight percent of all Georgia respondents said that they had made some change in their method of pesticide disposal since training. This was slightly higher than the percentage of positive responses for the study as a whole. The three common specific types of changed behavior in Georgia's responses were: burn them (13%), bury them (16%), and haul them to a landfill (11%). Somewhat disturbing is the small percentage (3%) of growers in Georgia who reported rinsing and/or crushing their containers as a result of training. These and other changes are summarized in the table below.

Disposal

Study Total: 37%
Georgia Respondents: 38%

burn them	13%
bury them	16%
rinse them	3%
crush or puncture them	3%
haul them to a landfill	11%
take them to a dump	5%
store them in special place awaiting disposal	3%
other differences	3%

In the last of the eleven impact areas, pesticide storage, only 29% of Georgia respondents noted changed behavior since training--one of the lowest of the impact areas. Also, unlike other areas, Georgia was third highest of the five states, following the two northeastern states. Still, Georgia's percentage of positive responses was slightly higher than for the study sample as a whole (26%). Specific types of changed behaviors, and the percentage of Georgia respondents reporting these changes, are found in the table below.

Storage

Study Total: 26%
Georgia Respondents: 29&

keep them locked	12%
keep them in special area/shed/building	15%
keep them away from children/animals	14%
wash/clean before storing	2%
store away from extreme heat	4%
other differences	4%

3.1.8 Total Behavioral Areas Impacted

To summarize the perceived impacts of training on the behavioral practices of the Georgia growers, the eleven behavioral impact areas are rank ordered by extent of reported impact. For comparison purposes, the rank order of each impact area for the study sample as a whole is also provided in the following table:

Georgia Rank Order	Study Total	Behavioral Impact Area	Percentage of Georgia Respondents Reporting Change Since Training
1	1	Clothing Worn While Mixing & Loading	49%
2	2	Handling Spills	43
3	3	Container Disposal	38
4	4	Drift Prevention	36
5	8	Clothing Worn While Spraying	33
6	5	Handling Leftovers	30
7	7	Pesticide and Equipment Storage	29
8	6	Equipment Calibration	28
9	9	Pesticide Transportation	28
10	10	Crop Damage Allowed	28
11	11	Pest Identification	27

Clearly, for both Georgia and for the study sample as a whole, behavior pertaining to personal safety appears at the top of the list. This pattern is even more pronounced for Georgia, e.g., where clothing worn during application ranks higher than calibration, in spite of the emphasis on calibration in the training course. It is possible that the larger number of small farms in Georgia -- where one would expect that growers would personally apply pesticides rather than contracting with a commercial applicator -- might contribute to this emphasis. In the following section of this chapter on Georgia, we will examine the reported behavioral practices of the Georgia growers in light of their background characteristics.

3.2 Reported Behavioral Impacts by Background Characteristics

It is possible that the effects of training -- as measured by reported changed behavior subsequent to training -- may be different for different types of respondents in Georgia. For example, those with higher levels of formal education might make more changes in behavior. To examine this issue, we correlated perceived change in behavior with six background characteristics: farm size, education, age, years of experience with pesticides, frequency of pesticide application, and amount spent on pesticides. Exhibit 3-3 summarizes these correlations across impact areas for the Georgia respondents by using the number of impact areas where changes were reported as the dependent variable of interest. The responses from Georgia show no statistically significant correlations between background characteristics and the number of behavioral impact areas where changes are reported.
are three statistically significant correlations with background characteristics: A negative correlation with farm size and positive correlations with respect to education and frequency of pesticide application. This third correlation suggests that those growers who apply pesticides more frequently are more likely to be those who implement changed behavior subsequent to training.

Exhibit 3-4 summarizes all of the statistically significant correlations between background characteristics and reported change in behavior for each of the eleven impact areas.

Of all of the impact areas, only one -- clothing worn while spraying -- showed significant correlations with several of the background characteristics. Changes in the area of clothing worn while spraying were negatively correlated with: farm size, age, years of experience using pesticides, and pesticide expenditures. Change in this area was positively correlated with education. The direction of the signs for these correlation coefficients is as one might expect, with the younger farmers, in smaller farms, with less experience, and lower expenditures on pesticides reporting most change. These are the growers who are likely to have the least experience and the most to gain from training. The positive correlation with education also suggests that a higher level of formal education facilitates changed behavior in this impact area.

Exhibit 3-3

Number of Behavioral Impact Areas with Reported Changes by Background Characteristics

	Georgia	Total Sample
Age	a	a
Education	a	.06
Farm Size	a	-.06
Years of Pesticide Experience	a	a
Frequency of Pesticide Application	a	.07
Pesticide Expenditures, 1980	a	a

[a] Indicates correlations are not statistically significant at the .05 level.

Exhibit 3-4

Reported Behavioral Impacts by Background Characteristics

	Pest Identification	Crop Damage Allowed	Transportation	Clothing While Mixing	Clothing While Spraying	Equipment Calibration	Drift Prevention	Handling Spills	Handling Leftovers	Pesticide Disposal	Pesticide Storage
Farm Size	-.12	a	-.12	a	-.08	a	a	-.09	a	a	-.09
Education	a	a	a	a	-.08	a	a	a	a	a	a
Age	a	a	a	a	-.10	-.10	a	a	a	.10	a
Years of Experience with Pesticides	-.09	a	a	a	-.10	a	a	a	a	a	a
Pesticide Usage per Year	a	a	a	a	a	a	a	a	a	a	a
Pesticide Expenditures Last Year	a	a	-.10	a	-.08	a	a	a	a	a	-.13

[a] Indicates correlations not statistically significant at the .05 level.

One might expect that if the correlation between background characteristics and reported change in behavior was high in this impact area, then it would also be high in the area of clothing worn while mixing and loading. But it is not. The column for mixing and loading on Exhibit 3-4 shows that impacts in this area are not correlated with any background characteristic, perhaps reflecting the higher percentage of Georgia growers who were already wearing appropriate gear for mixing and loading as opposed to spraying toxic pesticides.

Of the six types of background characteristics, only one -- farm size -- correlates with reported change in several different impact areas (five altogether). Two other background characteristics, age and pesticide expenditures last year, are correlated with change in three impact areas. The importance of farm size has been discussed frequently throughout this report, and it is not necessary to review its importance here again. Also, since farm size is positively correlated with pesticide expenditures, one can understand the importance of that background characteristic as a reflection of small farm size. The age variable, however, is more difficult to interpret, particularly since the sign of the coefficient is negative for the two areas and positive for one of the impact areas: pesticide disposal. Apparently, for that one impact area, older respondents are more likely to report change than are young respondents.

3.3 Reported Behavioral Impacts by Training Characteristics

Just as reported changes in behavior after training might be related to background characteristics, so might they also be related to the training characteristics of respondents. Four characteristics of training were examined: year of initial certification, training type (training session versus self-study), source of pesticide assistance (chemical dealer versus county agent), and overall assessment of training worth. Exhibit 3-5 summarizes the results for Georgia in a manner similar to Exhibit 3-3, above, i.e., we present the correlation between training characteristics and the number of behavioral impact areas where respondents have reported changes since training.

Exhibit 3-5

Number of Behavioral Impact Areas with Reported Changes by Training Characteristics

	Georgia	Total Sample
Year of Initial Certification	a	a
Training Type	a	a
Source of Pesticide Assistance	.14	.16
Assessment of Training Worth	.33	.33

[a] Indicates correlations are not statistically significant at the .05 level.

The results from Georgia respondents are almost identical to those reported in the study sample as a whole. There is a positive correlation between source of assistance and the number of areas where respondents reported changes in behavior since training, indicating that those respondents who said that their primary source of assistance was the county agent reported changes in more impact areas than those who said their source of assistance was the chemical dealer. The second positive correlation -- between number of impact areas reporting changed behavior and training evaluation -- shows that those growers who give positive assessments of training worth are also those who have most changed their behavior subsequent to training.

Exhibit 3-6 shows the correlations between these same four training characteristics and reported changes in the eleven separate impact areas. In the following paragraphs we will summarize and interpret these correlations.

Year of Initial Certification. This training characteristic was not correlated with the reported changes in specific impact areas. This shows that there is no difference -- in terms of reported impacts -- between those who were trained during the early years of training and those trained later.

Training Type. Training type -- training session or self-study -- was correlated with reported changes in only one impact area: clothing worn while spraying. The correlation coefficient ($r = -.10$) shows that the training session was more likely to be associated with reported changes in this area than was self-study.

Source of Pesticide Assistance. A correlation existed between this training variable and reported changes in several of the impact areas: pest identification, clothing worn while mixing and loading, clothing worn while spraying, drift prevention, and handling spills. A positive correlation coefficient, which appeared in every case, showed that those growers who said that the county agent was their source of assistance were more likely to report changes in behavior.

Exhibit 3-6

Reported Behavioral Impacts by Training Characteristics

	Pest Identification	Crop Damage Allowed	Transportation	Clothing While Mixing	Clothing While Spraying	Equipment Calibration	Drift Prevention	Handling Spills	Handling Leftovers	Pesticide Disposal	Pesticide Storage
Year of Initial Certification	a	a	a	a	a	a	a	a	a	a	a
Training Type	a	a	a	a	-.10	a	a	a	a	a	a
Source of Pesticide Assistance	.14	a	a	.15	.13	a	.11	.12	a	a	a
Assessment of Training Worth	.18	.20	.20	.29	.30	.23	.21	.21	.20	.21	.28

[a] Indicates correlations not statistically significant at the .05 level.

Assessment of Training Worth. More than any other training characteristic variable, this variable was correlated with reported behavioral changes -- in all of the eleven impact areas. As discussed above, this shows that a positive assessment of training worth is more likely to come from growers who learned something from the training and who probably implemented what they had learned. Hence, the reported correlation coefficients are positive and quite significant.

3.4 Reported Behavioral Practices of Nonimpacted Respondents

A substantial number of the Georgia respondents reported that they did not change their behavior after training. The percent answering no" in Georgia was smaller than in the other states in the study, but it was nevertheless a significant portion of the total sample of growers from that state. For those respondents who answered "no," we asked a follow-up question in eight of the impact areas. This follow-up question was designed to elicit statements from the growers about the prevailing procedures used by them in each impact area if these procedures/methods had not changed subsequent to training. The eight impact areas for which we asked this question were:

- transportation,
- clothing worn while mixing and loading,
- clothing worn while spraying,
- calibration,
- drift prevention,
- handling leftovers,
- pesticide disposal, and
- pesticide storage.

The answers provided by Georgia respondents in these eight impact areas are displayed in Exhibit 3-7. The dominant practice currently used by those respondents who were not affected by the training generally appears consistent with practices recommended in training. For example, of those respondents who said that their behavior had not changed in the area of pesticide transportation subsequent to training, 89% reported that their current method of transportation was to keep the pesticide in

Exhibit 3-7

Reported Behavioral Practices of Nonimpacted Respondents

	Georgia (%)	Total (%)
1. Methods of Pesticide Transportation		
Bed of Truck	89	84
Trunk of Car	4	4
Truck cab/car seat	5	4
Other method (e.g., closed container)	2	2
2. Clothing Worn When Mixing and Loading		
Waterproof gloves	48	64
Waterproof boots	7	12
Long-sleeved shirt	26	25
Long trousers	23	16
Goggles or glasses	18	29
Respirator or filter mask	11	17
Dust mask	23	22
Hat	9	15
Coveralls	16	22
Raincoat or rainsuit	7	10
Other clothing	5	4
None worn/necessary	19	12
3. Clothing Worn While Spraying		
Waterproof gloves	29	40
Waterproof boots	9	12
Long-sleeved shirt	29	27
Long trousers	25	19
Goggles or glasses	17	20
Respirator or filter mask	11	15
Dust mask	20	15
Hat	18	21
Coveralls	18	23
Raincoat or rainsuit	8	11
Other clothing	2	4
None worn/necessary	21	21
4. Frequency of Calibration		
Before each application	58	46
Before every other application	11	8
Before every 3 or 4 applications	12	13
Less often	17	22
Other (once a year)	2	6

Exhibit 3-7 (continued)

Reported Behavioral Practices of Nonimpacted Respondents

	Georgia (%)	Total (%)
5. Methods of Drift Prevention		
Spray when wind is low	74	80
Spray with wind direction	16	13
Spray during cooler times	3	4
Use lower pressure	5	10
Use larger nozzle opening	2	6
Use drift control agent	2	2
Spray closer to ground	12	11
Other method (e.g., not when raining)	15	18
No precaution taken/necessary	6	4
6. Methods of Handling Leftovers		
Drain it or bury it in ground	13	12
Leave it in applicator	5	4
Apply it to another field	4	5
Continue spraying until applicator empty	19	18
Dilute, then spray until applicator empty	3	2
Store in closed container	39	39
Don't have any leftover	13	18
Other methods (e.g., take to dealer)	11	12
7. Methods of Pesticide Disposal		
Burn them	31	37
Bury them	34	34
Rinse them	11	18
Crush or puncture them	8	14
Haul them to a landfill	29	22
Take them to a dump	23	15
Store them in a special place awaiting disposal	6	3
Other methods (e.g., take to dealer; re-use them)	7	8
8. Methods of Pesticide and Equipment Storage		
Keep them locked	16	14
Keep them in special area/shed/building	79	77
Keep them away from children/animals	12	10
Wash/clean before storing	24	24
Store away from extreme heat	7	7
Other methods (e.g., take to dealer)	7	8

the trunk of a car. That is an acceptable practice since it keeps the pesticide away from the driver. Similarly, for those respondents who said that their behavior in the area of clothing worn while mixing and loading had not changed subsequent to training, the most common type of clothing worn was rubber gloves (48%). This was also the most common response from those who reported that their behavior had changed after training (36%).

Specific answers, percentages of respondents choosing this answer in Georgia, and percentages of respondents choosing this answer in the full sample, are shown in Exhibit 3-7. Compared to the five state average, it can be seen that the nonimpacted growers in Georgia report considerably less protection while mixing, loading and spraying toxic pesticides, especially in terms of such items as waterproof gloves and boots, goggles, respirators, hats, and coveralls (reflective of Georgia's warm farming climate). In the area of equipment calibration, the fact that 85% of Georgia's nonimpacted respondents report calibrating their equipment before each application, compared to the 46% of the nonimpacted respondents in all five states, is particularly impressive given the moderate farm sizes in Georgia compared to the midwest (where good calibration practices are more economically motivated).

Current practices of Georgia private applicators in the areas of spray drift prevention, handling surplus pesticide, container disposal, and pesticide/equipment storage are, for the most part, very similar to the practices reported by the total sample of (nonimpacted) growers. These practices appear to be acceptable with only a few noticeable deficiencies. Methods of disposal and storage in Georgia (and in the other states as well) among private applicators are weak in terms of the low percentages of nonimpacted growers who report rinsing the empty containers (11%), crushing or puncturing them (8%), and keeping their pesticides and equipment locked up (16%). While these percentages would be higher with impacted respondents included and if the growers were specifically asked, for example, if they rinse their containers, it is still likely that the majority of Georgia's private applicators do not perform these important activities.

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EVALUATION OF THE PRIVATE APPLICATOR PESTICIDE TRAINING AND CERTIFICATION PROGRAM: A FIVE-STATE STUDY

APPENDIX B: Iowa Evaluation Report

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Prepared by Abt Associates Inc. for the Environmental Protection Agency and the Council on Environmental Quality under Contract No. EQ9AC014, as amended. Opinions expressed herein are those of the Contractor and do not necessarily represent the official views of the sponsoring and participating federal and state agencies.

AN EQUAL OPPORTUNITY EMPLOYER

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APPENDIX B

IOWA EVALUATION REPORT

The first training session for private pesticide applicators in Iowa was given in November 1975. By 1980, over 60,000 growers had been trained and certified as private pesticide applicators; since 1979, over 10,000 have been trained and recertified. One hundred county extension agents--one in each of the 100 counties in the state--have delivered the training program developed and supervised through the Cooperative Extension Service of Iowa State University. In partnership with the Iowa Department of Agriculture--the state lead agency serving as the regulatory agency--the Cooperative Extension Service estimates that 90% of all of Iowa's growers will have been trained and certified by the end of 1981.

The Iowa Extension Service realized the important link the dealer has in disseminating information on pesticides to the user, and special emphasis has been given for 20 years to educate and inform the Iowa dealer. ISU Extension cooperates with the strong Iowa Ag Chemical and Fertilizer Association, an organization with over 1,300 members. Every year, a two-day educational/history trade show is held, and each fall one dealer meeting is held in each of Iowa's 12 extension areas. Most of these dealers subscribe to the Insect, Weed and Plant Disease Newsletter. This weekly newsletter keeps the dealer informed of changes in laws, pests and pesticides. It also alerts the dealer to pest problems, so that they are kept as well informed as the county extension director. The county extension office is usually located in a community near the center of the county. It is believed to be more convenient for a farmer to stop in at his local dealer to ask questions about a pesticide than to contact the county extension officer, which may be 20-25 miles away. The important role of the chemical dealer is explored thoroughly throughout this report.

In the first section, the background characteristics of the study respondents are described. Next, the analysis of the Iowa Private Pesticide Applicator Training and Certification Program is presented. Principal characteristics of the training program are described along with the overall assessment of the program as reported by study respondents. In subsequent subsections, the specific advantages and disadvantages of the program and grower assessment of individual training elements are provided. The Report concludes with grower assessment of the certification program and the recertification program and provides a summary of the overall training assessment correlated with specific background characteristics of the respondent population. For the most part, survey responses are presented in their original categories (unlike Chapter 4, which merges many response cateogries), and comparisons with data from other states are limited to the five-state total for each variable.

1.0 ANALYSIS OF BACKGROUND CHARACTERISTICS

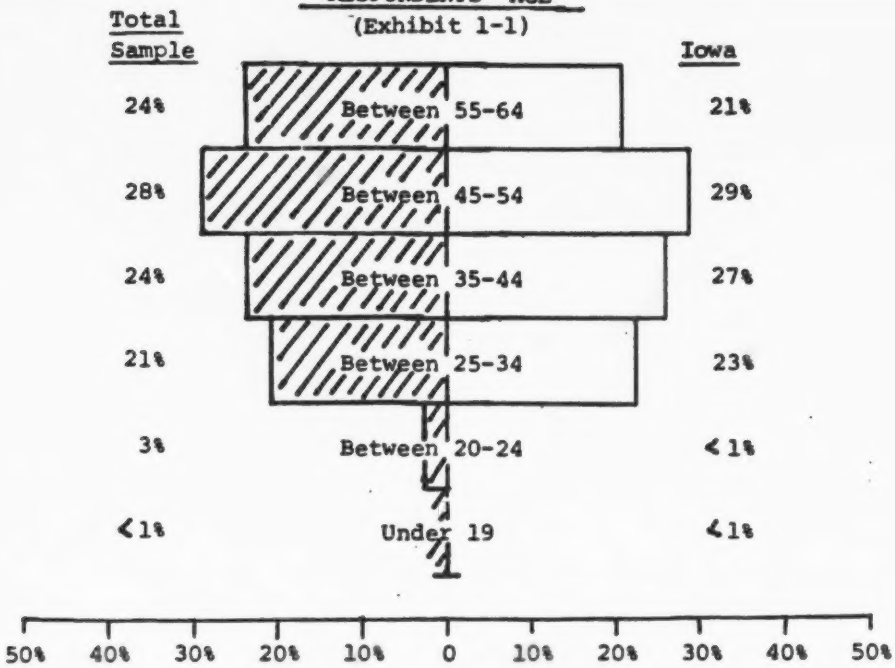
There were 414 private pesticide applicators who responded to the telephone questionnaire. In general, the respondents in Iowa were comparable, in terms of background characteristics such as age and education, with other study respondents. Exhibits 1-1 and 1-2 illustrate the respondents' age and education distribution for Iowa and the total study sample. Iowa had significantly greater numbers of respondents who reported being high school graduates than in the sample as a whole, but the total number of respondents reporting having at least a high school degree is comparable with the overall study average (i.e., 80% of the study respondents reported having at least a high school education.)

Nearly a third of the Iowa respondents were 45-54 years of age; the remainder of the sample being distributed relatively evenly between the age brackets of 25-44 years of age and 55-64 years of age. Less than 1% of the respondents reported being between 20-24 years of age. This age distribution is comparable with the average among other study respondents. As will be pointed out in subsequent sections of the analysis, neither age nor education correlates significantly with the reported impacts of training.

In terms of experience using pesticides, the Iowa respondent group had a greater proportion of respondents with 11-20 years of experience using pesticides than for the five states combined, but fewer growers with 21 years or more of experience. Exhibit 1-3 highlights that 68% of the growers in Iowa report having over 10 years of experience handling pesticides. Generally, however, the more experienced growers reported being neither more nor less impacted by the training than the inexperienced (i.e., less than 10 years) growers. The correlations between years of experience using pesticides and the relative impacts of training on a variety of pesticide handling and use behaviors will be further analyzed in Section 3.0.

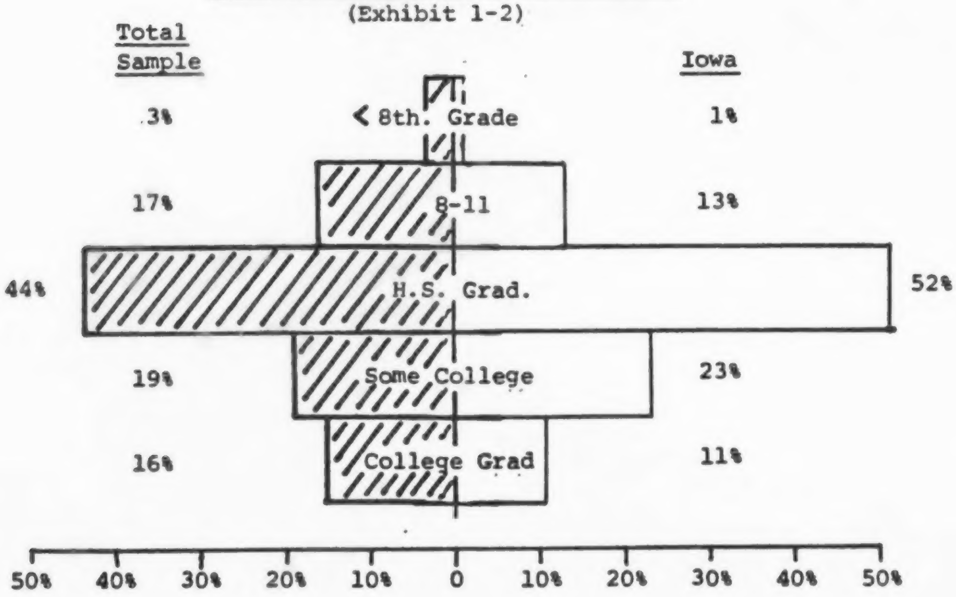
RESPONDENTS' AGE

(Exhibit 1-1)



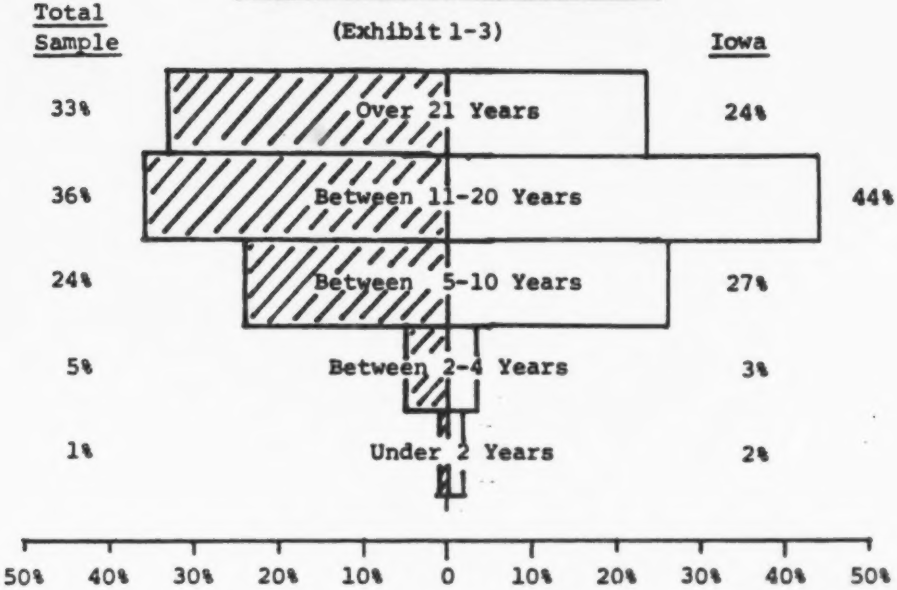
LAST YEAR OF SCHOOL COMPLETED

(Exhibit 1-2)



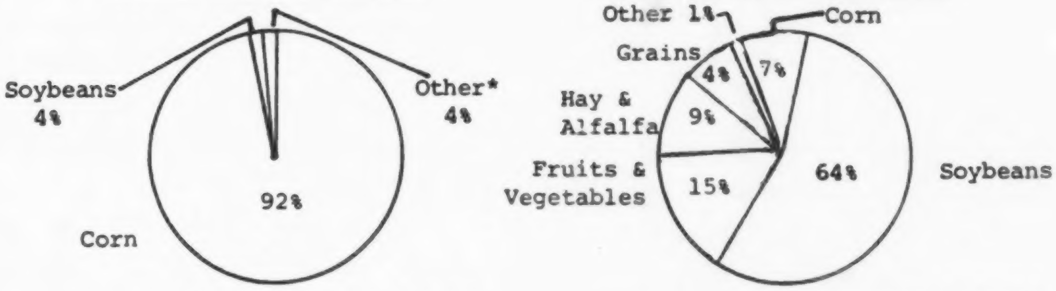
YEARS OF PESTICIDE EXPERIENCE

(Exhibit 1-3)



PRINCIPAL CROPS

(Exhibit 1-4)



Primary Principal Crop

Secondary Principal Crop

*Other includes: Hay and alfalfa; fruits and vegetables; animals.

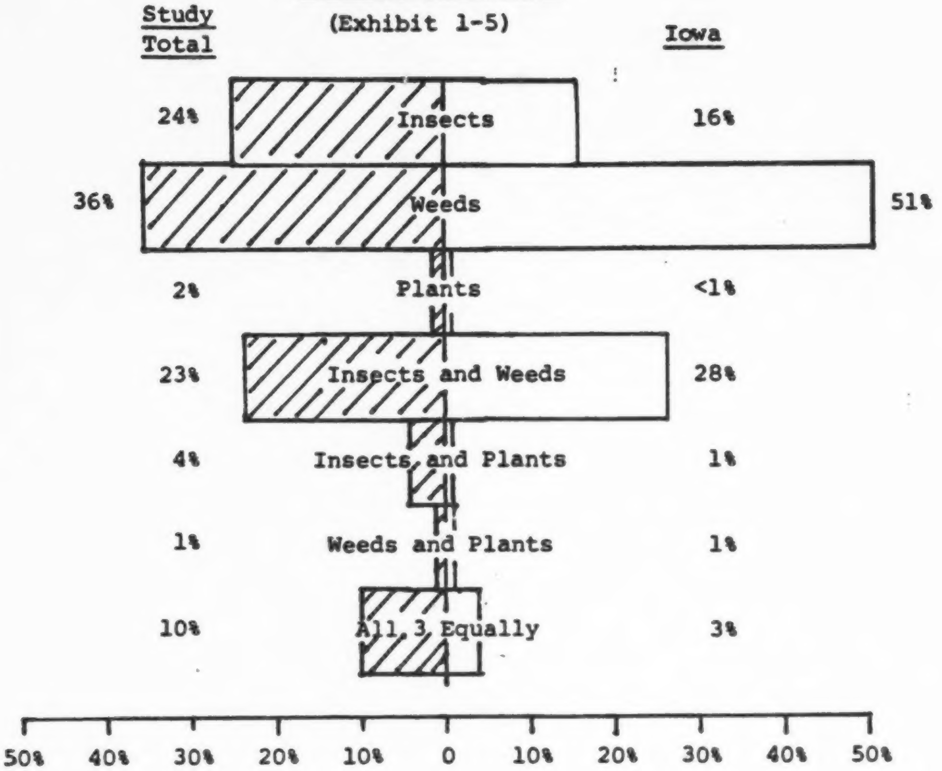
Other includes: Grass; animals.

Exhibits 1-4 and 1-5 display the principal crops and principal pests of Iowa's respondent growers. The principal crops have been displayed to highlight the most important crop mentioned first by the grower--Primary Principal Crop--and then the second principal crop mentioned--Secondary Principal Crop. The overwhelming primary principal crop is corn and the secondary principal crop is soybeans, followed by fruits and vegetables, hay and alfalfa, corn, hay and grains. Not surprisingly, therefore, the major use of pesticides (specifically herbicides) among Iowa growers is for the purpose of controlling mostly weeds as can be seen in Exhibit 1-5. At least 1 out of every 4 respondents also reported using pesticides to control a combination of insects and weeds, and another 16% indicated that they use pesticides to control mostly insects; a very small percentage of the Iowa growers reported using pesticides to control plant diseases.

The pest problem is generally concentrated on the corn rootworm, for which granular fumigation is done as needed--mixed into the soil before planting--and on the European cornborer, for which aerial applications of pesticides are made. (Estimates of the use of aerial applications of pesticides are difficult to obtain with accuracy, but estimates range from 10% to 70% for those Iowa growers who hire commercial applicators to do the aerial applications.) Common nonrestricted pesticides used in reportedly large quantities in Iowa include: terbutos (Counter); phorate (Thimet); carbofuran (Furadan); fonofos (Dyfonate); insecticides include: Amaze (for rootworm); thomyl (Lannate); and grain fumigants. Restricted herbicides include: paraquat; picloram (Tordon); and Hoelon. Most granular formulations of most rootworm insecticides are available for general use; only liquid concentrations are restricted.

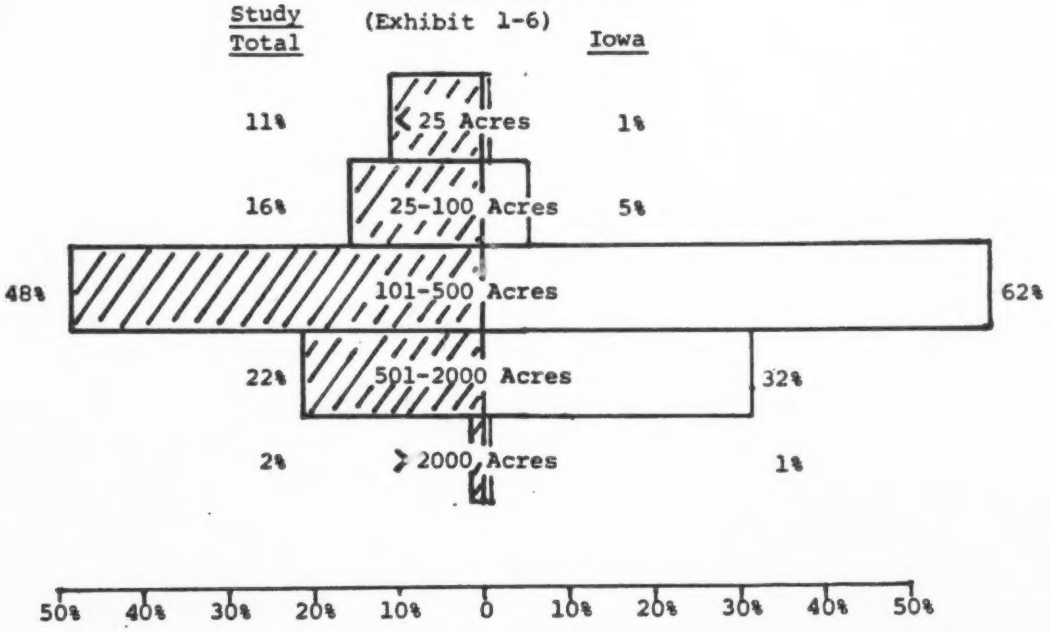
PRINCIPAL PESTS

(Exhibit 1-5)



ACRES FARMED

(Exhibit 1-6)

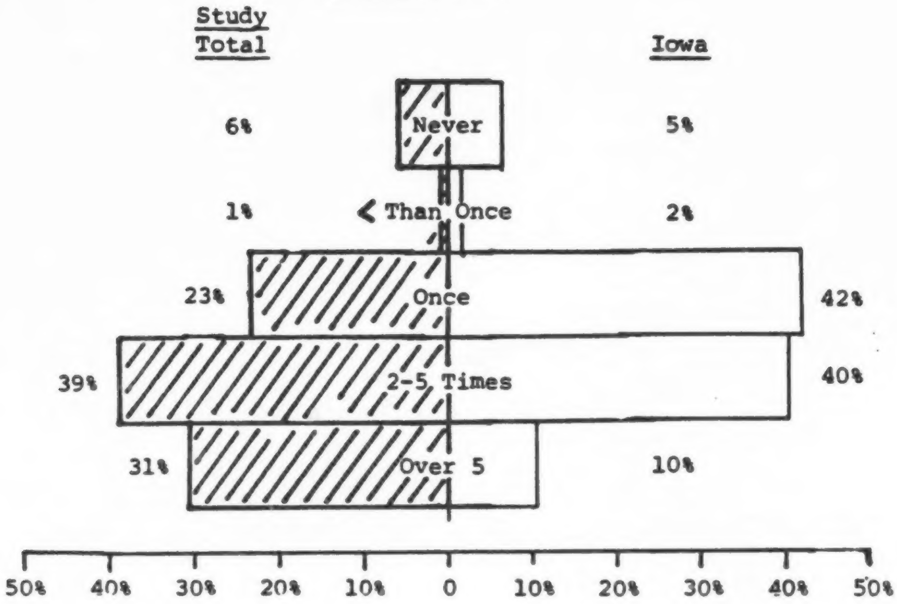


The strongest distinctions between Iowa growers and other respondents in the sample are in the areas of acres farmed, applications per year of pesticides, and dollars spent on pesticides per year. As a large corn-producing and soybean state, Iowa has a significantly higher percentage of growers with farms in the 100-500 acre and over-500-acre categories. As Exhibit 1-6 illustrates, only 5% of the Iowa growers reporting farming 100 acres or less, compared to 28% of the growers in the study sample as a whole. Because of the size of the farms in Iowa, and the nature of the crop-pest problem, Iowa growers spend considerabl more on pesticides--but need to apply less frequently--than other states in the sample. As Exhibits 1-7 and 1-8 indicate, about half of the growers in Iowa use pesticides once a year or less (compared to 30% of the sample) and only 11% apply six times a year or more (compared to 31% of the sample). Nonetheless, 80% of Iowa's growers reporting spending over $1000 last year on pesticides while only slightly more than half (57%) of the study sample reported spending as much. A major expenditure difference is noted where 23% of the Iowa respondents require more than $5000 per year in pesticides while only 18% of the sample as a whole spend in excess of $5000. Certainly the size of farms in Iowa accounts for a major portion of the significantly higher pesticide expenditures in that state, as may the expenditures associated with hiring commercial applicators to do aerial applications of pesticides.

In sum, therefore, the Iowa respondent grower is largely comparable in terms of other study respondents, excepting the larger farm size, the clear necessity of weed control priority in pesticide usage, and the associated less frequent, but more costly, applications of pesticides each year. In the following section, the Iowa Private Applicator Training and Certification Program is described and analyzed in terms of training program characteristics and overall assessment of the program by the growers.

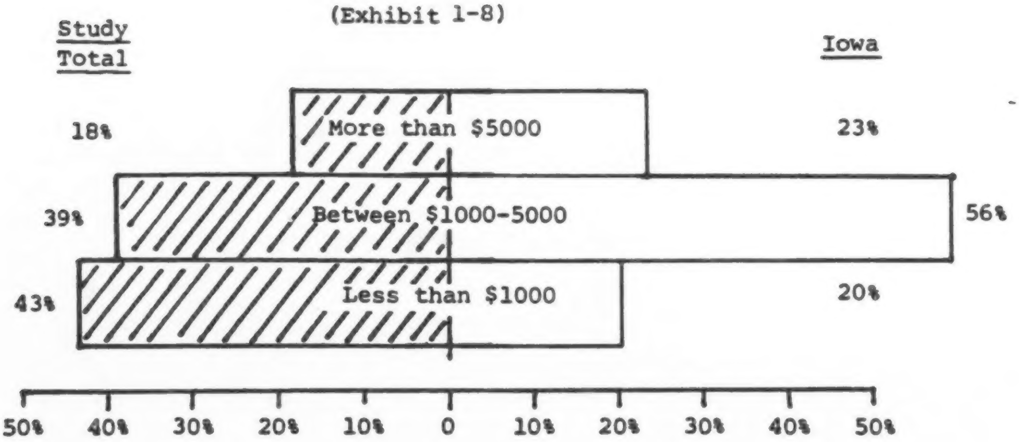
PESTICIDE APPLICATIONS PER YEAR

(Exhibit 1-7)



PESTICIDE EXPENDITURES LAST YEAR

(Exhibit 1-8)



2.0 ANALYSIS OF TRAINING PROGRAM CHARACTERISTICS

2.1 Program Description and Overall Assessment

Iowa requires participation in a 2-1/2 hour basic training session. No examination is required, and certification is virtually automatic upon the filing of a certification application--signed by the county extension agent who conducts the training--with a fee of $5.00 sent to the Iowa Department of Agriculture. There is a self-study option available, which requires the taking of a certification examination, but this has rarely been used since the method was formally abandoned and training requirements modified early in the program (approximately 11,000 applicators were certified in the first year on the basis of an examination only). Only 4% of the respondents to the survey reported having been trained by a self-study method.

The group training sessions are based on the use of the following training methods and materials:

- EPA Core Manual accompanied by an Iowa Supplement which adds material on poison control and treatment centers; provides a checklist for ways in which pesticide accidents can be avoided; provides a checklist of procedures for maintenance of pesticide application equipment; and provides a copy of the Iowa Pesticide Act, which details the requirements for the legal sale and regulation of pesticides in the state.

- Handouts on permissible pesticide disposal facilities; personal protective equipment necessary for handling specific types of pesticides; sprayer calibration; use of low pressure sprayer and granular application equipment for pest control; and a brochure for families on the symptoms of pesticide poisoning, first aid, and treatment of contaminated clothing.

- Colorado Slide/Tape Series revised from the basic series of eight scripted tapes to a set of six scripted tapes supplemented with overhead transparencies on changes in the law and procedures for specific pesticides.

- Worksheet and demonstration on sprayer calibration, worksheet on labeling, and demonstration on pest identification.

There is reportedly no use of a workbook or film during the training sessions, relying instead on the Manual, the Slide/Tape series, demonstrations, worksheets and lectures. Each of these individual training elements will be analyzed in Section 2.3. In general, the training emphasizes the topics of calibration and safety in the handling, mixing, and application of pesticides, and the handling of leftovers.

Finally, before considering the overall assessment of respondents to Iowa's Private Applicator Training and Certification Program, it is important to note that Iowa farmers use virtually no restricted pesticides, because they rely upon granular formulations of rootworm insecticides, available for general use. Only liquid concentrations above 45% are restricted. The fact that certain pesticides which the growers expected to become restricted (and require certification) did not become restricted as anticipated has caused a reported level of uncertainty among growers as to the continued need for a Private Applicator Training and Certification Program. Inherent in the question of need for the training program and private pesticide applicator certification is the issue of where else the grower may go to get information about pesticides.

In order to determine where a grower would be most likely to go to obtain information about pesticides (specifically, if not sure about how to use a pesticide or which pesticide to use), each grower was asked to identify where he would be most likely to go for help. This open-ended question--responses by growers were recorded as provided--was coded into the following categories:

- neighbor or relative
- chemical dealer, supplier, or company sales representative
- state department of agriculture official
- vocational agriculture teacher
- farm magazines and publications
- other

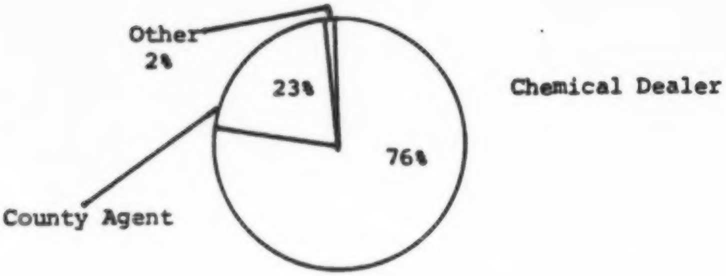
Exhibit 2-1 indicates that 76% of the respondents reported that they were most likely to go to their chemical dealer or equivalent and only 23% were most likely to utilize the services of the county extension agent. In the study sample as a whole, only 47% of the respondents reported reliance on the chemical dealer or equivalent as the most likely source of pesticide assistance. The chemical dealer seems to be a convenient source of such information in Iowa, and the reliance on the chemical dealer suggests a significant role for chemical dealers (or chemical dealer associations) in influencing grower handling of pesticides. Chemical dealers represent a potentially ready source for information about pesticides which could be formally recognized and incorporated into the program, particularly for recertification.

One potential indicator of the degree of satisfaction that the grower has with the usefulness of training sessions (e.g., in providing the type of information which the grower needs when unsure about how to use a pesticide or which pesticide to use) is the overall rating of training. Exhibit 2-2 compares the rating of Iowa's growers to the overall study total on the issue of how worthwhile the growers found the state private applicator training program to be. The response categories were: "very worthwhile," "somewhat worthwhile," or "not very worthwhile." A significantly smaller percentage of Iowa growers found the training to be very worthwhile, although a slightly higher percentage found it to be somewhat worthwhile than was reported in the study as a whole. A considerably higher number of Iowa growers also rated the overall worth of training as not very worthwhile. In fact, Iowa respondents gave the highest negative overall rating of training of any of the five states in the study.

The apparent lack of enthusiasm for the worth of the training in Iowa--measured by the relatively small number who found the training "very" worthwhile and the relatively large number who found it "not very" worthwhile--coupled with the high frequency with which the Iowa grower prefers to go to his chemical dealer or equivalent (rather than the county extension agent) for assistance in deciding to use and using pesticides, can be further investigated by considering some of the

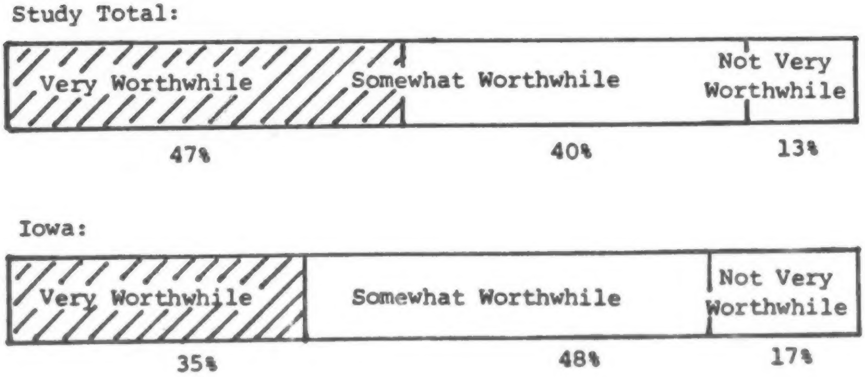
SOURCE OF PESTICIDE ASSISTANCE

(Exhibit 2-1)



PERCEIVED WORTH OF TRAINING

(Exhibit 2-2)



specific advantages and disadvantages the Iowa grower cites for the Private Pesticide Applicator Training and Certification Program. These are examined below.

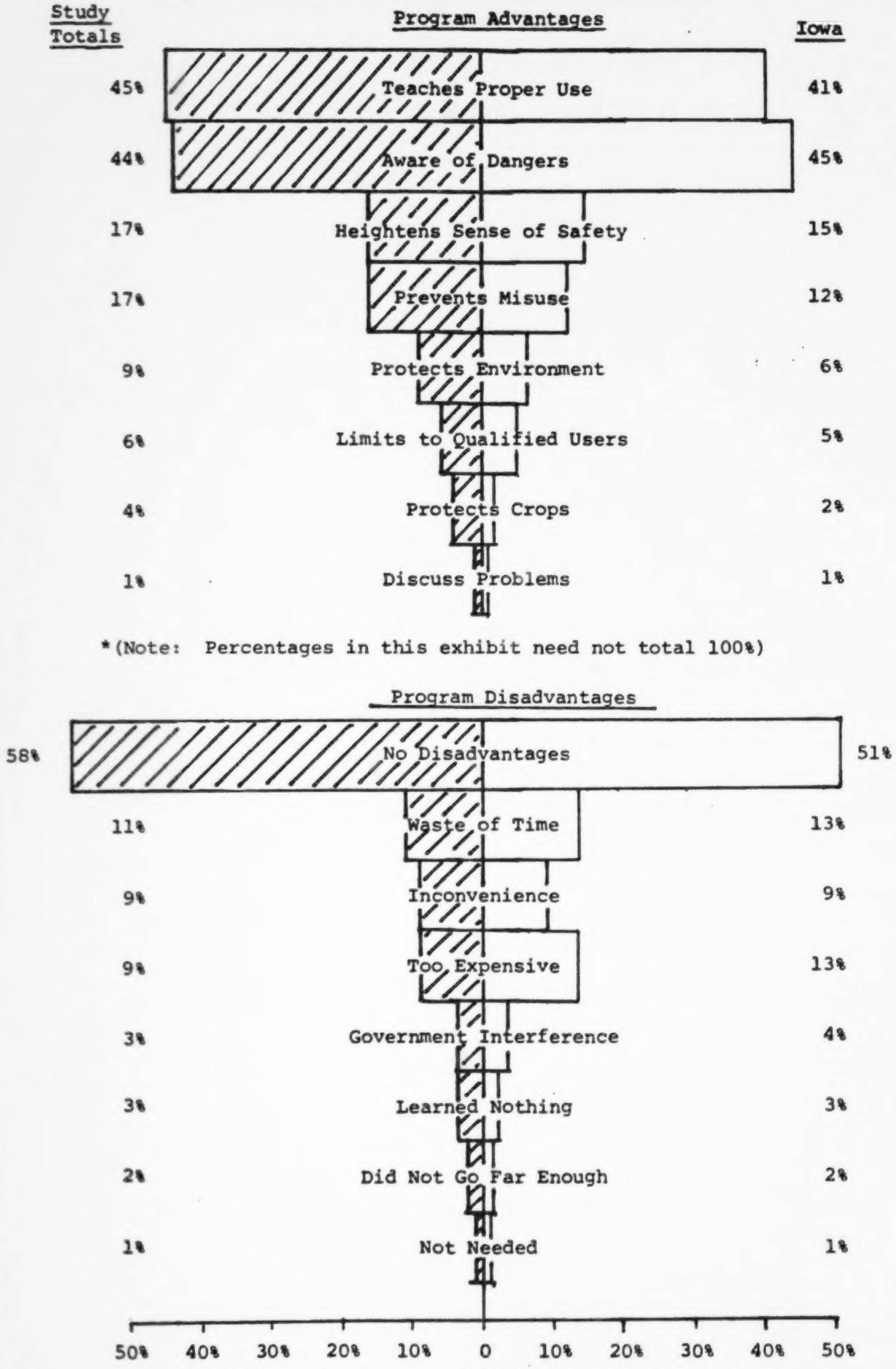
2.2 Advantages and Disadvantages of the Program

Respondents were asked to describe what they thought the advantages of having a state private applicator training and certification program were, and then they were asked to describe their perceptions of disadvantages. The open-ended nature of the question tends to strengthen the importance of each of the voluntary responses to this series of questions, a display of which is provided in Exhibit 2-3.

In terms of program advantages, the largest percentages of responses cited the fact that the program creates an awareness of the dangers of pesticide usage (45%) and the need for safety precautions in using pesticides (15%). Taken together, these two advantages were cited with comparable frequency in the study total (61%) and were the most frequently cited program advantages. Forty-one percent of the Iowa responses fell into the category of "proper use" and 12% "prevent misuse," which are possible analogs to safety and further support the notion that Iowa's training program is viewed by the growers as offering particular advantages when it comes to personal safety awareness and related behaviors. Iowa's growers cited less frequently advantages associated with the protection of crops, livestock, or the environment than did the study respondents as a whole.

In terms of disadvantages, 51% of the respondents said there were "no disadvantages," and this was comparable to its frequency in the total study (58%). More interesting are the disadvantages cited by those who believed the program to have specific disadvantages. About 26% of the responses were evenly divided into reactions that the program was either a waste of time or too expensive. In part, this reaction (only 20% fell into these categories for the study as a whole) may be a reflection of the perceived lack of utility of a program which trains and certifies private pesticide applicators (and charges a fee for certification) in a state where few pesticides are restricted and few require certification

ADVANTAGES AND DISADVANTAGES OF THE STATE PRIVATE APPLICATOR TRAINING AND CERTIFICATION PROGRAM (Exhibit 2-3)*



*(Note: Percentages in this exhibit need not total 100%)

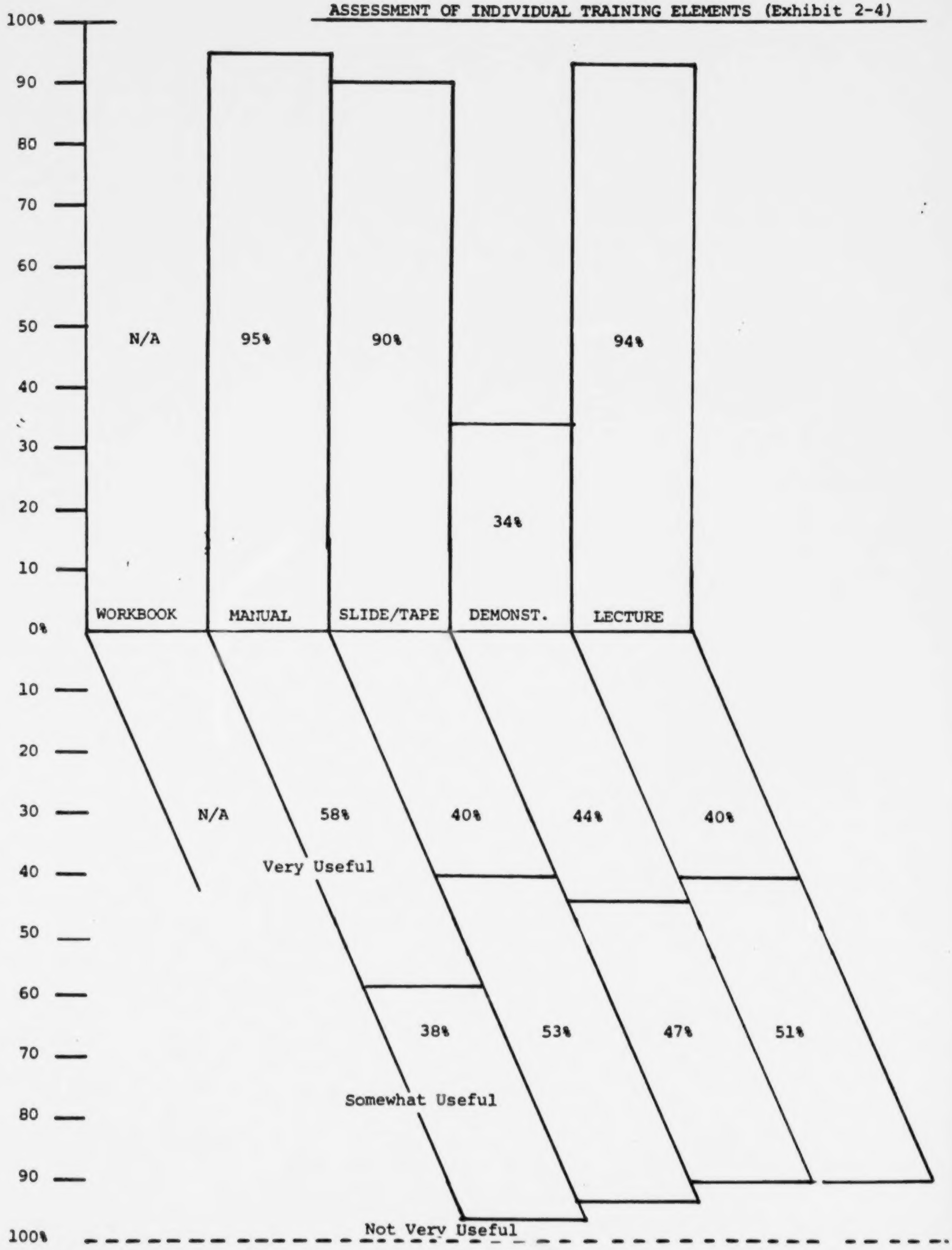
for use by the farmer. Presumably, the additional 13% of the responses which cited "inconvenience to farmers" as a particular disadvantage may reflect some of the related hostility growers feel about being required to attend a training session to acquire certification which they do not need.

2.3 Assessment of Individual Training Elements

In order to determine whether or not particular aspects of the training program were perceived by the grower as having greater or lesser value than others, growers were asked to indicate whether or not their training sessions included any of the following items: 1) slide/tape program; 2) film or videotape; 3) demonstration program; 4) lecture; 5) training manual; and 6) workbook. For each item which the grower indicated he had during training, he was asked to indicate whether he found the particular item to be "very useful," "somewhat useful," or "not very useful." An identical series of questions (omitting demonstrations and lectures) was asked of those who indicated they received their training by self-study. Since the Iowa Private Applicator Training and Certification Program does not include a workbook or a film, the analysis which follows necessarily focuses only on the growers' assessment of the slide/tape series, the demonstrations, the lectures, and the training manuals used in the training sessions (and used by the scant 4% of the respondents who reported receiving training by the self-study method.)

Exhibit 2-4 displays these four training methods. The bar at the top illustrates the total percentage of respondents who indicated that they received each method; whether by training session or self study. The bars on the bottom of Exhibit 2-4 display the usefulness ratings for each of the methods reported received and assessed by the growers.

ASSESSMENT OF INDIVIDUAL TRAINING ELEMENTS (Exhibit 2-4)



As Exhibit 2-4 illustrates, over 90% of the growers reported having used the slide/tape series, received lectures, and/or received a manual during the training (the remainder of the respondents either did not know whether or not they received one of these methods--i.e., they had forgotten--or the category was not applicable to them, for example, self-study respondents did not receive lectures. Because of the small number of respondents reporting self-study, their assessment of methods is aggregated with the training session group.

About one out of every three growers experienced some type of demonstration during training; typically in Iowa this would be a demonstration on calibration or pest identification. Of the four categories of methods, well over half of the respondents reported the manual as being very useful and only 4% found the manual not very useful. The assessed usefulness of the slide/tape series, the demonstrations, and the lectures statistically are not significantly different from each other, and the Iowa responses are comparable with the study group as a whole.

When compared to the overall averages for the study group, Iowa growers rated the usefulness of the manual about the same (56% of the study total found the manual to be very useful). With respect to the slide/tape method, 7% fewer of the respondents in Iowa found this method very useful, although slightly more Iowa respondents found the slide/ tape method to be at least somewhat useful. Significant differences are noted when comparing the respondents' ratings of the demonstrations and lectures. In the study as a whole, 53% of the respondents found demonstrations to be very useful; in Iowa only 44% found demonstrations to be very useful. With respect to lectures, 47% of the study respondents and only 40% of the Iowa respondents, found the lectures to be very useful; in fact, nearly 10% of the Iowa respondents reported that they found the lectures to be not very useful, and 8% found the demonstrations not very useful. In light of the dependence on lecture and demonstration during the Iowa training sessions, the rating of demonstration by the Iowa growers is disappointing.

2.4 Initial Certification and Assessment of Certification

In order to distinguish the possible difference between the overall perceived value of training from the overall perceived importance of requiring pesticide certification for private applicators, growers were asked to indicate how important they felt it is for Iowa to have a restricted pesticide certification program for private applicators, using a rating scale of "very important," "somewhat important," and "not very important."

For purposes of comparison, Exhibit 2-5 displays the growers' rating of the importance of certification alongside the growers' overall rating of the worth of training. Nearly a quarter of the respondents indicated that certification was not very important, while only 17% indicated that training was not very worthwhile. Nonetheless, a slightly higher percentage of respondents found certification to be very important than did those who found training very worthwhile. In balance, the growers tend to feel very strongly about the importance of certification--either it is or is not very important--while about half of the respondents rated the training as simply somewhat worthwhile. It may be that more growers are able to yield some benefit from training, but only those who need certification or perceive a direct benefit from it are likely to perceive certification as very important. In general, the growers in Iowa seem more to accept the value of training (83% rating the training at least somewhat worthwhile) than perceive positively the importance of certification. Given the general lack of need for certification in Iowa because of the crops grown and the pesticides used, the fact that Iowa growers felt more negatively about the importance of certification than any other state in the sample (the study average for "not very important" was 17%) is not surprising.

Exhibit 2-6 displays the cycles in which Iowa growers were initially certified along with the recertification cycles anticipated by certification expiration. Respondents were asked to indicate the year in which they first received their state private applicator's certification and the year in which their initial certification is expected to expire. Twenty-seven percent (27%) of the respondents indicated that they did not know when they received their initial certification and 37% reported not knowing when their certification expires. Exhibit 2-6 displays adjusted frequencies and cumulative frequencies for initial certification and year of certification expiration in order to permit an examination of the historic trends in certification and consideration of the expected demands for recertification among Iowa's growers.

The largest percentage of growers were initially certified in Iowa during 1978, and once completed, this cycle represented the training and certification of approximately 90% of the respondent growers to eventually become certified. Slightly more than half of the respondents reported that they expect their certification to expire during 1981, consistent with the number of years (three) for which the certification is valid. The graph on the bottom of Exhibit 2-6 displays the peaks for both certification and recertification, and indicates that Iowa had already recertified about 30% of the growers by the end of 1980, a cycle which is generally well ahead of the other states, with the exception of Nebraska. In the early years of 1975 and in 1976, Iowa was providing training and certification to growers at an accelerated pace when compared to other states in the sample.

2.5 Recertification Status and Assessment of Recertification

Growers were asked to indicate if they were already recertified and whether or not they planned to become recertified. Exhibit 2-7 illustrates that only 75% of the growers plan to be recertified; one out of every four of the growers indicated that they either planned not to be recertified or had not yet decided. The number who do not plan to be recertified in Iowa (19%) is significantly larger than the percentage

PERCEIVED IMPORTANCE OF CERTIFICATION AND OVERALL WORTH OF TRAINING (Exhibit 2-5)

IMPORTANCE OF CERTIFICATION

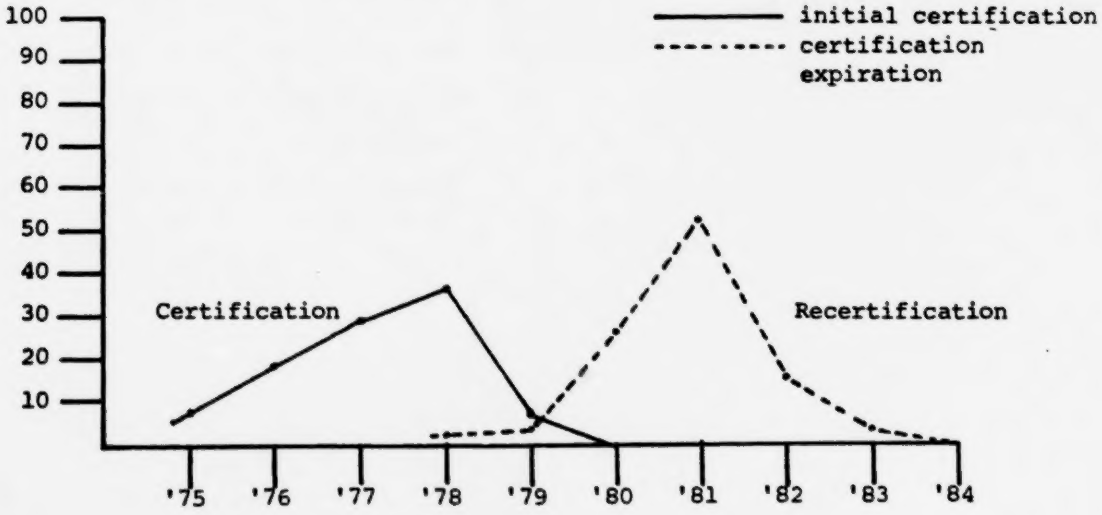
Very Important	Somewhat Important	Not Very Important
39%	38%	23%

OVERALL WORTH OF TRAINING

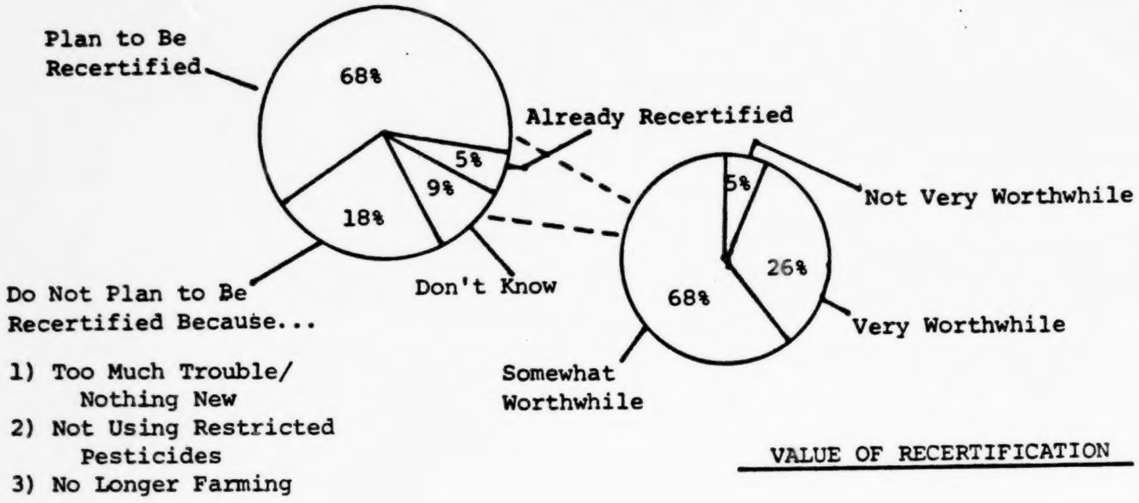
Very Worthwhile	Somewhat Worthwhile	Not Very Worthwhile
35%	48%	17%

(Exhibit 2-6)

YEAR OF INITIAL CERTIFICATION	YEAR OF CERTIFICATION EXPIRATION
1975: 8%	1978: 1%
1976: 18%	1979: 2%
1977: 29%	1980: 27%
1978: 37%	1981: 52%
1979: 8%	1982: 15%
1980: -0-	1983: 2%
	1984: .5%
	1985: .5%



RECERTIFICATION PLANS (Exhibit 2-7)



for the study as a whole (9%). When asked why they did not plan to become recertified, Iowa respondents cited three main reasons (although the vast majority of respondents provided no specific reason at all): too much trouble or offered nothing new; not using restricted pesticides; and no longer farming. Although extremely small percentages of respondents provided reasons for not recertifying, these specific reasons may provide some insight into why such a large percentage of respondents in Iowa do not plan to be recertified. In light of the admitted lack of a need for certification to apply most pesticides in Iowa, it is surprising that even a greater number of growers did not report "not using restricted pesticides" as the reason they had decided not to become recertified. In any event, because the recertification process serves to disseminate important information about pesticides to the growers, it may serve a valuable function regardless of whether or not restricted pesticides are needed or used.

In order to develop a sense of the overall value of recertification, recertified growers were asked to assess whether or not the recertiication program was "very worthwhile," "somewhat worthwhile" or "not very worthwhile." As Exhibit 2-7 indicates, for those 5% of the growers who did indicate they had already been recertified, one out of every four found recertification to be "very worthwhile," two out of three found it to be "somewhat worthwhile," and a relatively few respondents (5%) found it "not very worthwhile." When compared to similar overall ratings (by those recertified) of the initial Iowa training program, a general decline in perceived worth was observed: for those recertified, the perceived value of training was higher than the perceived value of the recertification.

2.6 Training Assessment by Background Characteristics

In order to determine whether or not particular respondents reported training being more or less worthwhile than others, the background characteristics of the Iowa growers were examined in light of their overall assessment of training worth. Spearman nonparametric correlation coefficients were computed and the correlations for Iowa and the study group as a whole, which are statistically at the 95% confidence level, are displayed below:

Background Characteristics	Iowa	Study Total
• number of acres farmed	-.15	-.16
• last year of school completed	-.08	-.05
• age	.14	.09
• years of pesticide experience	a	-.04
• spent on pesticides last year	-.18	-.14
• training or self-study	a	a

[a] indicates correlation is not statistically significant at the .05 level.

Generally, the growers who are older, have smaller farms, and have less formal education tended to rate the training as more worthwhile, both in Iowa and across other states in the study. In the study sample as a whole, those with fewer years of experience using pesticides also tended to rate the training as being more worthwhile, although this correlation did not hold true for respondents in Iowa. The correlation which indicates that those who spent less on pesticides last year, both in the study as a whole and in Iowa, tended to rate the training as more worthwhile, is likely related to the number of acres farmed (i.e., the fewer the acres the less the expenditures). No significant relationship exists between type of training (session versus self-study) and overall assessment of worth.

Additional analysis of the reported behavioral impacts for Iowa respondents--including the relationship between reported impacts and background characteristics--is described in detail in the following section of this report.

3.0 ANALYSIS OF BEHAVIORAL CHARACTERISTICS

For the 94% of the respondent growers in Iowa who reported using pesticides within the last three years to control insects, weeds, or plant diseases, a series of questions was asked to determine the perceived impacts of training in eleven pesticide-related grower behaviors:

- methods of pest identification
- amount of crop damage allowed
- methods of pesticide transportation
- clothing worn while mixing and loading
- frequency of equipment calibration
- clothing worn while spraying
- methods of spray drift prevention
- methods of handling spills on skin or clothing
- methods of handling leftovers
- methods of pesticide and equipment storage
- methods of pesticide container disposal

These eleven pesticide handling practices correspond to those activities which are stressed in the EPA core manual, as well as the supplementary materials emphasized in Iowa's training program. For example, training topics emphasized include: reading labels; calibration; safety in the handling, mixing, and application of pesticides; the handling of leftover pesticides; and container disposal. Training program demonstrations further emphasize calibration and pest identification.

As described in Section 4.3 of the Comprehensive Evaluation, the specific wording of the behavioral questions consisted of a "yes or no" impact question followed by an open-ended request for specific differences since training, for impacted growers, or specific practices before training, for nonimpacted growers. In Section 3.1 below, we analyze the reported impacts of training on Iowa growers' behaviors. In Section 3.2 the background characteristics of Iowa's grower respondents are related to perceived impacts of training, and in Section 3.3 several key training variables are analyzed in relation to reported behavioral impacts. Finally, in Section 3.4 an analysis is provided of those respondents who perceived no impact of training on given pesticide handling practices. Interpretations of the reported behaviors on nonimpacted respondents help to determine whether or not those growers who reported being unaffected by training in some behavioral areas were employing generally acceptable methods of handling restricted pesticides prior to training. The absence of behavioral impacts since training may be attributed to the lack of need for training in specific behavioral areas; i.e., no change is needed or desired.

3.1 Reported Behavioral Impacts

One way of obtaining an overview of the extent to which Iowa respondent growers were influenced by training is to consider the average number of behavioral areas reported being affected by the study respondents as a whole as compared with those of Iowa respondents. Exhibit 3-1 displays the number of respondents in Iowa, and in the study total, who reported no impacts of training along with the number who reported from 1 to 11 reported behavioral areas impacted. (It is important to keep in mind that these frequencies examine behavioral areas impacted and that within each area there may be one or more behaviors which were influenced by training.)

As can be seen from Exhibit 3-1, 70% of Iowa's grower respondents, and 76% of the study respondents as a whole, reported being affected in at least one of the behavioral areas targeted by training. Nearly half of the respondents reported changes after training in at least one of the behavioral impact areas; about 20% reported being affected in five or more behavioral areas. When compared with the study sample as a whole, however, Iowa grower respondents reported changes in significantly fewer impact areas than any other of the four states in the study.

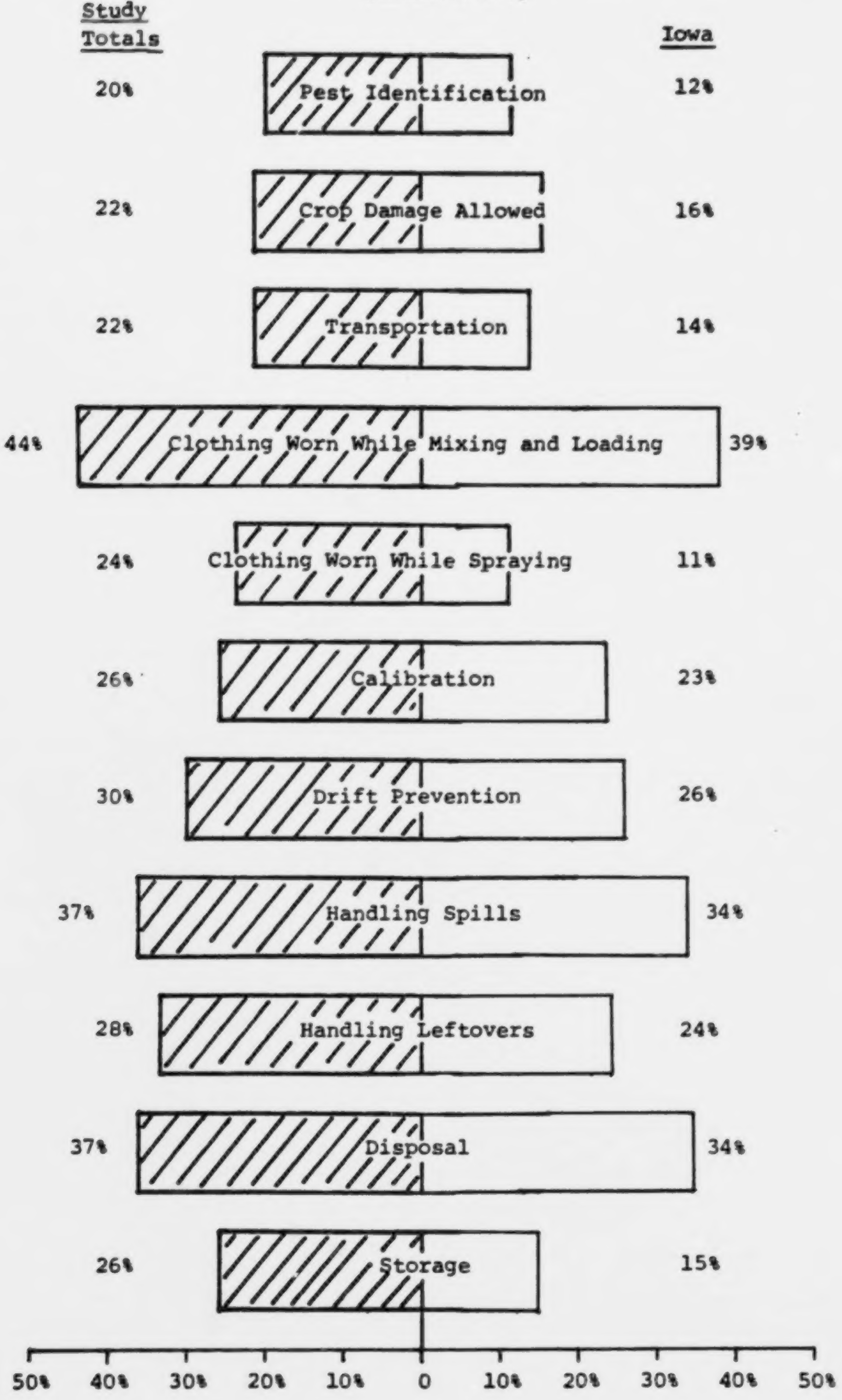
In order to examine in which of the eleven behavioral areas the Iowa growers perceived some impact, the percentage of respondents in Iowa and in the study total reporting perceived impacts in each of the eleven behavioral areas is displayed on Exhibit 3-2. In no area did the Iowa respondents report perceived impacts of a magnitude equal to or greater than the study total. Significantly weaker impacts are shown in the areas of pest identification, transportation, spraying, and storage.

Exhibit (3-1)

Number of Reported Behavioral Areas Impacted

Number of Behavioral Areas Impacted	Iowa		Study Total	
	Relative Frequency	Cumulative Frequency	Relative Frequency	Cumulative Frequency
0	30%	30%	24%	24%
1	17	47	13	37
2	13	60	11	48
3	10	70	11	59
4	10	80	10	69
5	6	86	9	78
6	4	90	7	85
7	4	94	5	90
8	3	97	4	94
9	2	99	3	97
10	1	100	2	99
11	--	--	1	100

PERCEIVED IMPACTS OF TRAINING
(Exhibit 3-2)



Areas which are more comparable with study averages include mixing and loading, calibration, spray drift prevention, handling spills, handling leftovers, and disposal. Because it is possible that reported impacts in some of these behavioral areas are weaker than study averages because the Iowa grower's pretraining behavior was already acceptable and did not need to change, a closer examination of the nonimpacted respondents is provided in Section 3.4 at the end of the chapter. Each of the eleven behavioral practices will be examined individually below.

3.1.1 Pest Identification and Crop Damage Allowed

The Iowa Private Applicator Training and Certification program emphasizes pest identification by offering demonstrations on the subject. Given this emphasis--and the generally higher ratings for this training method--one might expect the respondents to report relatively higher impacts of training in this area. As shown below, only 12% of the Iowa respondents reported impacts in this area as compared to 20% of the study respondents. When asked whether or not they felt there had been a difference since training in the methods they used to determine what kind of pest is causing the problem, the Iowa growers reporting some difference were asked to cite specific differences. It should be noted that a small percentage of all respondents in each state (<10%) mentioned any specific difference and, for the five states together, pest identification was the behavioral area least impacted by training. The specific differences most often cited in Iowa included those displayed below:

Pest Identification

Study Total: 20%
Iowa Respondents: 12%

better informed/identification	3%
closer inspection of pest	3%
check with county agent	1%
better pest/pesticide matching	2%
other differences (e.g., use pest management program, more judicious spraying)	3%

The growers were next asked whether or not they perceived any differences since training in the amount of crop damage they allow (before spraying) in situations where they had not planned on using pesticides. The frequency of reported changes after training in this area correspond roughly to those reported for the pest identification area, both for Iowa and the study as a whole (22% of the study total and 16% for the Iowa respondents). When asked what specific differences the respondents experienced, 3% indicated they allow more damage and 2% indicated they allow less damage; an additional 7% reported that they are simply more aware of pesticides and more concerned (perhaps restrained) in their application of pesticides.

Crop Damage Allowed

Study Total:	22%
Iowa Respondents:	16%

allow more damage	3%
allow less damage	2%
other differences	7%

3.1.2 Pesticide Transportation

When asked about differences since training in their methods of transporting pesticides, less than 10% of the total sample of respondents mentioned any single impact of training on their methods of pesticide transportation. Even for those who did report differences since training, Iowa respondents reported disproportionately lower impacts in this area as well. As indicated below, when asked for specific differences since training most respondents simply stated that they were more careful in general.

Transportation

Study Total:	22%
Iowa Respondents:	14%

more careful in general	6%
keep in truck bed or trunk	3%
keep in closed container	3%
other differences (e.g., have pesticides delivered, separate herbicides and insecticides)	3%

3.1.3 Clothing Worn When Mixing and Loading Pesticides

The most substantial impact reported by all of the states in the study was in the area of differences since training in the protective clothing and equipment worn by the grower when mixing and loading pesticides that have a skull and crossbones symbol on the label. Over 40% of the sample reported differences in this impact area. Although Iowa respondents were somewhat below the study average,[1] differences since training in clothing worn when mixing and loading represents the highest impact area for Iowa growers. As indicated below, in terms of specific differences, the largest single impact reported by Iowa respondents is the use of waterproof gloves while mixing and loading pesticides.

Clothing Worn When Mixing and Loading

Study Total:	44%
Iowa Respondents:	39%

waterproof gloves	32%
waterproof boots	2%
long-sleeved shirt	8%
long trousers	1%
goggles or glasses	20%
respirator or filter mask	5%
dust mask	7%
hat	1%
coveralls	3%
raincoat or rainsuit	1%
other differences	1%

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[1] It is estimated that 95% of Iowa's pesticide (mostly insecticides) applications do not require rubber gloves, boots, mask, cartridge respirator, goggles and rubber coats like New York's apple growers must wear when applying pesticides to orchards with an air blast sprayer. The Iowa taining program emphasizes the potential danger of overexposure to granular soil insecticides, emphasizing the care and caution needed when filling applicator boxes, calibration and field burning of paper and/or cardboard containers. Iowa farmers had been using granular soil insecticides on 4-6 million acres prior to 1975.

The second largest specific impact reported by the Iowa growers after training was the wearing of goggles or glasses when mixing and loading pesticides with a skull and crossbones symbol on the label.

3.1.4 Equipment Calibration

Approximately one-fourth of both the Iowa respondents and the study respondents as a whole reported differences since training in the methods by which, or frequency with which, they calibrate their application equipment. Because the Iowa respondents generally reported applying pesticides less frequently than respondents in other states--attributable in part to the nature of the crops grown and the pest problems--impacts with respect to frequency of calibration are especially interesting. Calibration is also a topic which is emphasized by means of demonstration in the Iowa training sessions. As illustrated below, nearly 10% of those reporting being impacted since training with respect to calibration, report that they are calibrating more carefully:

Calibration

Study Total: 26%
Iowa Respondents: 23%

calibrate more carefully	9%
calibrate more often	5%
measure more carefully	3%
follow instructions more closely	2%
other differences	6%

There is an added economic incentive to calibrate as carefully as possible given the size of the farms in Iowa and the potential dollar savings to the farmer to apply only the amount that is needed. Yet, the percentage of Iowa respondents reporting changes in this area after training was still lower than in the full study sample.

3.1.5 Pesticide Spraying and Drift Prevention

Of all eleven impact areas, Iowa growers reported the smallest number of behavioral changes after training in the area of protective clothing worn during spraying. This may be the result of the fact that many of Iowa's growers utilize granular formulations, and the fact that much of the large-scale (aerial) spraying is contracted out to commercial applicators in Iowa. The problem may be irrelevant to the average farmer in Iowa when compared to a grower in the Eastern states. Percentages of respondents indicating specific types of changed behavior in this area are shown in the table below.

Clothing Worn While Spraying

Study Total:	24%
Iowa Respondents:	11%

waterproof gloves	6%
waterproof boots	1%
long-sleeved shirt	3%
long trousers	1%
goggles or glasses	5%
respirator or filter mask	2%
dust mask	3%
hat	1%
coveralls	1%
raincoat or rainsuit	1%
other differences	0%

In terms of the specific differences in drift prevention since training, Iowa growers were comparable with the full study sample. The specific changes in behavior mentioned most frequently by Iowa respondents was spraying when the wind is low, a practice which the grower respondent could influence even if the spraying is done by a commercial applicator.

Pesticide Drift Prevention

Study Total: 30%
Iowa Respondents: 26%

spray when wind is low	16%
spray with wind direction	3%
spray during cooler times	2%
use lower pressure	7%
use larger nozzle opening	6%
use drift control agent	2%
spray closer to ground	1%
other differences (e.g., not when raining)	9%

3.1.6 Handling Pesticide Spills and Leftovers

When asked whether or not there was any difference since training in what he would do if a small amount of undiluted pesticide were spilled on skin or clothing, a sizable percentage of Iowa respondents indicated that there were positive differences in their behaviors, as illustrated below:

Handling Spills

Study Total: 37%
Iowa Respondents: 34%

wash more quickly	12%
wash more thoroughly	13%
remove clothing	14%
more careful in general	3%
more likely to read label	1%
other differences (e.g., contact physician)	1%

A strong improvement in personal safety behavior is reflected in these post-training results in the area of handling spills. Iowa growers also report relatively strong positive effects of training on the way in which they handle leftovers:

Handling Leftovers

Study Total: 28%
Iowa Respondents: 24%

store in closed container	7%
drain it or bury it in ground	3%
spray same field until empty	1%
dilute, then spray same field	0%
apply it to another field	2%
don't have any leftover	2%
other differences (e.g., take it to a dealer)	6%

It is important to note that 3% of the Iowa growers, as well as comparable percentages of growers in other states, reported burying the pesticide or draining it onto the ground since training, a procedure not recommended in training.

3.1.7 Pesticide Storage and Disposal

The percentages of respondents who perceived impacts on their methods of storing their pesticides and equipment varied little across the other states, but in Iowa, 11% fewer respondents reported differences since training than did the sample as a whole. Of the differences reported, most respondents indicated they now keep their pesticides in a special shed.

Pesticide Storage

Study Total: 26%
Iowa Respondents: 15%

keep them locked	3%
keep them in special shed	7%
keep them away from children/animals	6%
wash/clean before storing	1%
store away from extreme heat	3%
other differences (e.g., take to dealer)	3%

In terms of disposal of the empty pesticide containers, the reported perceived impacts across the states holds true for Iowa as well. Of the specific behaviors reported, rinsing the empty containers was reported most often in Iowa, followed by hauling the containers to a landfill. Since there are relatively few sanitary landfills to which the growers can conveniently take the empty containers--the distances to the landfills discourage this method of disposal--a relatively new emphasis has been placed on experimental disposal pits located on the grower's own property. These charcoal pits may serve as an appropriate method of disposal for some growers and may account for the small percentage of growers who reported specific differences in disposal since training and the relatively high percentage who reported rinsing the containers.

Disposal

Study Total: 37%
Iowa Respondents: 34%

burn them	5%
bury them	7%
rinse them	16%
crush or puncture them	7%
haul them to a landfill	9%
take them to a dump	3%
store them in a safe place awaiting disposal	1%
other differences (e.g., take them to a dealer)	5%

To summarize the perceived impacts of training on the specific behavioral practices of the Iowa growers, the eleven behavioral impact areas are rank ordered below by extent of impact. For comparison purposes, the rank order of each area for the study group as a whole is also provided.

Iowa Rank Order	Study Total	Pesticide-Related Behavioral Category	% of Iowa Respondents Who Perceived Impacts Attributable to Training
1	1	Clothing Worn When Mixing and Loading	39%
2	2	Methods of Handling Spills	34%
3	3	Methods of Container Disposal	34%
4	4	Methods of Spray Drift Prevention	26%
5	5	Methods of Handling Leftovers	24%
6	6	Methods of Equipment Calibration	23%
7	10	Amount of Crop Damage Allowed	16%
8	7	Methods of Pesticide and Equipment Storage	15%
9	9	Methods of Pesticide Transportation	14%
10	11	Methods of Pest Identification	12%
11	8	Clothing Worn While Spraying	11%

Clearly, both for Iowa and the study respondents as a whole, behaviors pertaining to personal safety appear to be at the top of the list of affected behaviors since training. The pesticide usage practices in Iowa (the dependence on granulars, for example) and the tendency for many farmers to contract out for the commercial aerial application of pesticides, may account for the relatively lower priority given to clothing worn while spraying than in the other states in the study. Overall, however, at least 70% of Iowa's respondent growers reported being affected in at least one behavioral area since receiving the private pesticide applicator training. In the following section, the reported behavioral changes of the Iowa growers are examined in light of their reported background characteristics to determine whether or not growers with particular sets of characteristics were more or less impacted by the training program.

3.2 Reported Behavioral Impacts by Background Characteristics

The perceptions of Iowa respondents of differences since training in their methods of handling pesticides were examined in relation to six background characteristics: age, education, years of pesticide experience, acres farmed, pesticide applications per year, and pesticide expenditures last year. Spearman nonparametric correlation coefficients were computed relating each background variable to the total number of behavioral impacts reported by each grower. In the following paragraphs, the associations between reported behavioral impacts and particular background characteristics are discussed. In these paragraphs, we first discuss the correlations between background characteristics and the number of impact areas where changes were reported, as shown in Exhibit 3-3. Then, we focus on correlations between background characteristics and reported changes in specific impact areas, as shown in Exhibit 3-4.

Respondent's Age. There was no significant association between the respondent's age and the number of reported behavioral changes since training in four out of five of the states in the study, including Iowa. Older growers were no more or less likely to benefit from training than were the younger growers.

Respondent's Education. Here too, there was no significant association in any of the states in the study, including Iowa, between the respondent's education level and the reported number of impacts as a result of training. The theory that the less formally educated grower may benefit more from the private applicator training program than the well educated grower is not supported by the data (with the exception of a mild correlation possibly associated with Pennsylvania's strong self-study option. The self-study option is examined closely in Appendix D (the Pennsylvania Evaluation Report). It should be noted that a mild correlation does appear in the Iowa data between those with more formal education and a reported impact in the area of calibration (r=.09). This mild association might reflect the utility of greater facility with the mathematics of calibration among the better educated growers in Iowa.

Exhibit 3-3

Number of Behavioral Impact Areas with Reported Changes by Background Characteristics

	Iowa	Total Sample
Age	a	a
Education	a	.06
Farm Size	a	-.06
Years of Pesticide Experience	a	a
Frequency of Pesticide Application	a	.07
Pesticide Expenditures, 1980	a	a

[a] Indicates correlations are not statistically significant at the .05 level.

Years of Experience. Although no significant correlation appears between a respondent's years of experience using pesticides and the number of perceived impacts as a result of training, there is a mild association in Iowa between fewer years of pesticide experience and reported impacts in the areas of clothing worn while mixing (r=-.10) and pesticide disposal (r=-.09). Given recent changes in recommended methods for pesticide disposal, the less experienced pesticide user in Iowa may be more inclined to adopt changed practices than the grower who has been using the same pesticide disposal methods for several years.

Acres Farmed. A mild negative correlation (r=-.06) exists for the five states together between size of farm and number of reported behavioral areas impacted indicating that the grower on a larger farm is somewhat less likely to report impacts of training than the smaller farmer; however, no such association between size of farm and behavioral impacts of training appears in Iowa, regardless of whether or not the 11 behavioral areas are taken together or individually.

Pesticide Applications Per Year. As in the other four states in the study, there appears to be a moderate positive association between the frequency of pesticide applications and the number of perceived behavioral changes reported by Iowa growers. Although the associations are fairly weak (r=.10 and .09, respectively), there is some association among Iowa growers who apply pesticides more often and reported impacts in the areas of calibration and pesticide disposal. Certainly part of the first association is attributable to the fact that the farmer who applies pesticides more often is likely to be more sensitive to the need for, and importance of calibration. Poorly calibrated equipment can result in costly pesticide application where the application is frequent on large numbers of acres.

Pesticide Expenditures Last Year. No significant association exists in any of the study states between the level of 1980 (i.e., "last year") pesticide expenditures and the number of reported impacts of training on behavior. However, there were a number of mild associations reported by Iowa respondents between the amount spent last year in five reported behavioral impact areas. Specifically, there were relatively

Exhibit 3-4

Correlation of Reported Behavioral Impacts by Background Characteristics

	Pest Identification	Crop Damage Allowed	Transportation	Clothing While Mixing	Clothing While Spraying	Equipment Calibration	Drift Prevention	Handling Spills	Handling Leftovers	Pesticide Disposal	Pesticide Storage
Farm Size	a	a	a	a	a	a	a	a	a	a	a
Education	a	a	a	a	a	.09	a	a	a	a	a
Age	a	a	a	a	a	a	a	a	a	a	a
Years of Pesticide Experience	a	a	a	-.10	a	a	a	a	a	-.09	a
Pesticide Usage per Year	a	a	a	a	a	.10	a	a	a	.09	a
Pesticide Expenditures Last Year	-.09	-.12	a	-.09	a	a	-.09	-.09	a	a	a

[a] Indicates correlations not statistically significant at the .05 level.

weak negative correlations between expenditures and reported impacts in the areas of: pest identification (r=.09); crop damage allowed (r=-.12); clothing worn while mixing and loading (r=.09); drift prevention (r=.09); and handling spills (r=.09). The growers who spend more on pesticides are likely to be influenced least in these areas.

3.3 Reported Behavioral Impacts by Training Characteristics

The Iowa grower's perceptions of differences in behavior since training were examined in relation to four training-related variables: 1) year of initial certification; 2) training type (training session v. self-study); 3) source of pesticide assistance (chemical dealer versus county agent); and 4) overall assessment of training worth. Exhibit 3-5 shows the correlations between training characteristics and the number of impact areas where changes were reported, both for Iowa and for the study area as a whole. Exhibit 3-6 displays a summary of the correlations between these training-related variables and the growers' perceptions of differences in behavior in each of the eleven behavior categories. As in the previous section, only statistically significant (at the .05 level) associations are reported.

In the discussion of each of the training characteristics that follows in the paragraphs below, we first will highlight correlations between training characteristics and the number of impact areas where changes were reported. Then we will focus on specific impact areas.

Year of Initial Certification. None of the states in the study demonstrated any relationship between the respondent's year of certification and the number of reported impacts, indicating that those private applicators trained relatively recently (i.e., 1979-1980) perceived about as many changes in their post-training behavior as did the private applicators trained early in the program. In Iowa, however, a mild negative correlation (r=-.11) was found between year certified and behavior changes in the areas of pesticide transportation, disposal, and storage. For these three practices, it appears that the early trainees in Iowa seem to have benefited slightly more than the later trainees. In part, this relatively mild association may reflect the fact that some

Exhibit 3-5

Number of Behavioral Impact Areas with Reported Changes by Training Characteristics

	Iowa	Total Sample
Year of Initial Certification	a	a
Training Type	a	a
Source of Pesticide Assistance	a	.16
Assessment of Training Worth	.35	.33

[a] Indicates correlations are not statistically significant at the .05 level.

Exhibit 3-6

Correlation of Reported Behavioral Impacts by Training Characteristics

	Pest Identification	Crop Damage Allowed	Transportation	Clothing While Mixing	Clothing While Spraying	Equipment Calibration	Drift Prevention	Handling Spills	Handling Leftovers	Pesticide Disposal	Pesticide Storage
Year of Initial Certification	a	a	-.11	a	a	a	a	a	a	-.12	-.11
Training Type	a	a	a	a	a	.a	a	a	a	a	a
Source of Pesticide Assistance	a	a	.a	.13	.19	.12	a	a	.11	a	.09
Assessment of Training Worth	.18	.20	.19	.27	.16	.22	.22	.26	.17	.22	.19

[a] Indicates correlation not statistically significant at the .05 level.

behavioral changes, like pesticide transportation and storage, could have been influenced by changing pesticide handling practices in general, and that those trained later had already adopted acceptable practices before participating in the training. The potential influence of acceptable pretraining behaviors is examined further in Section 3.4 which asesses reported behavioral practices of the respondents who reported no impact in one or more of the eleven behavioral areas identified.

Training Type. There is no association among the reported behavioral impacts and the method by which respondents were trained; those who were trained by the self-study method reported as many behavioral changes post-training as those who participated in training sessions. The number of self-study respondents in Iowa, however, is extremely small (approximately 4%), and the lack of correlations is not as meaningful as it is for Pennsylvania, where respondents are more evenly divided by training type.

Assessment of Training Worth. There is a strong positive relationship between the respondent's total number of perceived impacts and his rating of the training worth. In Iowa, as in the other states in the study, those private applicators who perceived many differences in their behavior since training tended to rate the training considerably more favorably than those who perceived few, if any, differences in their behavior (r=.35).

Source of Pesticide Assistance. Since the pesticide user has two primary sources for assistance and information about pesticides--the county agent and the chemical dealer--it is interesting to consider the potential relationship between source of pesticide assistance and reported posttraining impacts. In all states in the study except Iowa, the growers who stated that they would most likely go to their local county agent as opposed to their chemical dealer for pesticide assistance tended to be those who felt the most influenced by the training (r=.16 for the total sample). This relationship, whose causal direction is debatable, is particularly important in Iowa, where over 75% of the respondents indicated that they would be most likely to go to their chemical dealer for assistance in using pesticides or deciding what pesticides to use. In Iowa there are mild correlations between source of assistance and reported change in particular behavior areas. Those most likely to go to their county agents were more likely to report being impacted by training in the areas of clothing worn while mixing and loading (r=.13); clothing worn while spraying (r=.19); calibration (r=.12); handling leftovers (r=.11) and pesticide storage (r=.09). It is possible that those respondents who go to the chemical dealer rely on the dealer primarily for information related to pest identification or pesticide choice and not for the health and safety aspects of pesticide handling and usage. Since the reported impacted behaviors by those who are more likely to use the county agent are primarily health-related behaviors, the high percentage of respondents reporting reliance on chemical dealers in Iowa may suggest that the opportunity to influence growers in health-related behaviors is missed without greater general reliance on the county agent for pesticide-related information.

3.4 Reported Behavioral Practices of Nonimpacted Respondents

As described in Section 3.4, for 8 of the 11 pesticide handling behavioral areas included in the survey, those respondents who perceived no impact of training for a given behavioral area were asked (in an open-ended fashion) to describe how they currently perform that behavior to determine whether or not the absence of a training impact was related to pretraining behaviors. Exhibit 3-7 displays the percentage of nonimpacted respondents for each of the 8 behavior areas, broken out by specific behavioral practices reported by nonimpacted respondents.

It is interesting to note that although Iowa respondents generally reported lower frequencies of posttraining behavioral changes, the nonimpacted growers in Iowa report using more recommended practices than in the other four states in the study. For example, 97% of the Iowa nonimpacted respondents reported transporting pesticides in the bed of a truck or trunk of a car, which may explain the lower behavioral impact of training on transportation in Iowa than in the other states surveyed. Overall, only 4% of the study sample report placing the pesticides in the cab of the truck or the seat of the car, and even fewer in Iowa (2%) report doing so.

Exhibit 3-7

Reported Behavioral Practices of Nonimpacted Respondents

	Iowa (%)	Total (%)
1. Methods of Pesticide Transportation		
Bed of Truck	95	84
Trunk of Car	2	4
Truck cab/car seat	2	4
Other method (e.g., closed container)	1	2
2. Clothing Worn When Mixing and Loading		
Waterproof gloves	69	64
Waterproof boots	4	12
Long-sleeved shirt	33	25
Long trousers	19	16
Goggles or glasses	51	29
Respirator or filter mask	8	17
Dust mask	19	22
Hat	12	15
Coveralls	19	22
Raincoat or rainsuit	0	10
Other clothing	1	4
None worn/necessary	7	12
3. Clothing Worn While Spraying		
Waterproof gloves	37	40
Waterproof boots	5	12
Long-sleeved shirt	33	27
Long trousers	21	19
Goggles or glasses	29	20
Respirator or filter mask	5	15
Dust mask	10	15
Hat	15	21
Coveralls	23	23
Raincoat or rainsuit	1	11
Other clothing	2	4
None worn/necessary	24	21
4. Frequency of Calibration		
Before each application	49	46
Before every other application	11	8
Before every 3 or 4 applications	12	13
Less often	20	22
Other (once a year)	7	6

Exhibit 3-7 (continued)

Reported Behavioral Practices of Nonimpacted Respondents

	Iowa (%)	Total (%)
5. Methods of Drift Prevention		
Spray when wind is low	80	80
Spray with wind direction	15	13
Spray during cooler times	3	4
Use lower pressure	20	10
Use larger nozzle opening	13	6
Use drift control agent	5	2
Spray closer to ground	12	11
Other method (e.g., not when raining)	20	18
No precaution taken/necessary	5	4
6. Methods of Handling Leftovers		
Drain it or bury it in ground	17	12
Leave it in applicator	1	4
Apply it to another field	3	5
Continue spraying until applicator empty	18	18
Dilute, then spray until applicator empty	2	2
Store in closed container	39	39
Don't have any leftover	15	18
Other methods (e.g., take to dealer)	12	12
7. Methods of Pesticide Disposal		
Burn them	27	37
Bury them	19	34
Rinse them	36	18
Crush or puncture them	23	14
Haul them to a landfill	28	22
Take them to a dump	10	15
Store them in a special place awaiting disposal	1	3
Other methods (e.g., take to dealer; re-use them)	14	8
8. Methods of Pesticide and Equipment Storage		
Keep them locked	9	14
Keep them in special area/shed/building	74	77
Keep them away from children/animals	11	10
Wash/clean before storing	24	24
Store away from extreme heat	7	7
Other methods (e.g., take to dealer)	10	8

With respect to the protective clothing worn when mixing and loading, one out of every two of the nonimpacted respondents in Iowa indicated that they were currently wearing goggles/glasses, compared to only 29% overall. Even though the interpretation of the correct protective clothing to be worn must take into consideration climatic and pesticide use differences across the states, the percentages of currently acceptable practices among the Iowa nonimpacted growers mitigates to some extent the generally lower posttraining reported impacts in comparison with the other states.

When examining the lists of clothing and protective gear reportedly worn while spraying pesticides with a skull and cross bones symbol on the label among the nonimpacted Iowa growers, 24% report that they do not wear any, or that none are necessary, in comparison to 21% overall. In part, this may be due to the heavy reliance on granualar pesticides and the use of commercial aerial application of other pesticides, so that the grower in Iowa is simply not exposed as frequently to spraying hazards, which require protective gear.

Ideally, growers should calibrate their equipment before each application, and with the large farms reported in Iowa there should be an economic incentive not to overapply pesticides. Nearly half of the Iowa nonimpacted respondents indicated that they calibrate before each application.

The most commonly employed method of preventing pesticide drift is to spray when the wind is low, as reported by 80% of the Iowa respondents. More than other states, Iowa growers also reported using lower pressure as a method of controlling spray drift. In general, both the impacted and nonimpacted respondents in Iowa reported using at least one or two of the generally well-accepted methods of controlling spray drift.

When asked how they handled leftover pesticide when the job is finished, the most common response of the nonimpacted respondents in Iowa was to drain it into the ground or bury it. To the extent that the containers will be stored for a relatively short period of time, storing it in a closed container--as do 39% of the nonimpacted respondents in

Iowa--is a proper procedure. Since the Iowa applicators reported that they apply pesticides less frequently than respondents in the other states in the study, it is not surprising that only 1% of the nonimpacted respondents indicate that they handle leftovers by leaving them in the applicator.

Some interesting differences are observed among the states in the study with respect to pesticide disposal, or disposing of the empty containers. The most common practice reported in Iowa is to rinse the containers (36%). The most common practices reported overall were incineration (37%) and burial (35%), but these were relatively unused practices in Iowa (only 19% reported burying them). Iowa also had the highest percentage of growers who punctured the containers (23%) and hauled them to a state-approved landfill (28%).

Lastly, with respect to reported practices among nonimpacted respondents in the area of methods of pesticide and equipment storage, nearly three out of every four Iowa respondents indicated that they keep them in a special area or shed, and this is similar to reported behaviors of nonimpacted respondents overall. A surprisingly low percentage of the nonimpacted Iowa growers reported keeping their pesticides locked (9%) in comparison to the study total (14%). Although this may reflect both a less pressing need (i.e., the use of considerably fewer highly toxic pesticides), the practice is still less than desirable and represents a current behavior which may be the subject for emphasis during recertification.

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EVALUATION OF THE PRIVATE APPLICATOR PESTICIDE TRAINING AND CERTIFICATION PROGRAM: A FIVE-STATE STUDY

APPENDIX C: Nebraska Evaluation Report

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Prepared by Abt Associates Inc. for the Environmental Protection Agency and the Council on Environmental Quality under Contract No. EQ9AC014, as amended. Opinions expressed herein are those of the Contractor and do not necessarily represent the official views of the sponsoring and participating federal and state agencies.

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APPENDIX C

NEBRASKA EVALUATION REPORT

The first training session for private pesticide applicators in Nebraska was given in 1977. By 1980, over 45,000 growers had been trained and certified as private pesticide applicators; this figure is estimated to be almost 100% of those required by law to be certified. The recertification process began in December of 1980. Training sessions are conducted by county agents at 830 sites, approximately ten sites in each of 91 counties. The training and certification process is a joint federal and state activity, with the Cooperative Extension Service of the University of Nebraska in Lincoln being responsible for the curriculum and the Regional Office of the Environmental Protection Agency (EPA) in Kansas City issuing certification licenses and enforcing regulations.

In the following section the background characteristics of the study respondents in the Nebraska Private Pesticide Applicator Training and Certification Program are described. In Section 2.0 the principal characteristics of the training program are described along with the overall assessment of the program as reported by study respondents. In subsequent sections, the specific advantages and disadvantages of the program and grower assessment of individual training elements are provided. This chapter concludes with grower assessment of the certification program, the recertification program, and with a summary of the overall grower training assessment correlated with specific background characteristics of the respondent population.

1.0 ANALYSIS OF BACKGROUND CHARACTERISTICS

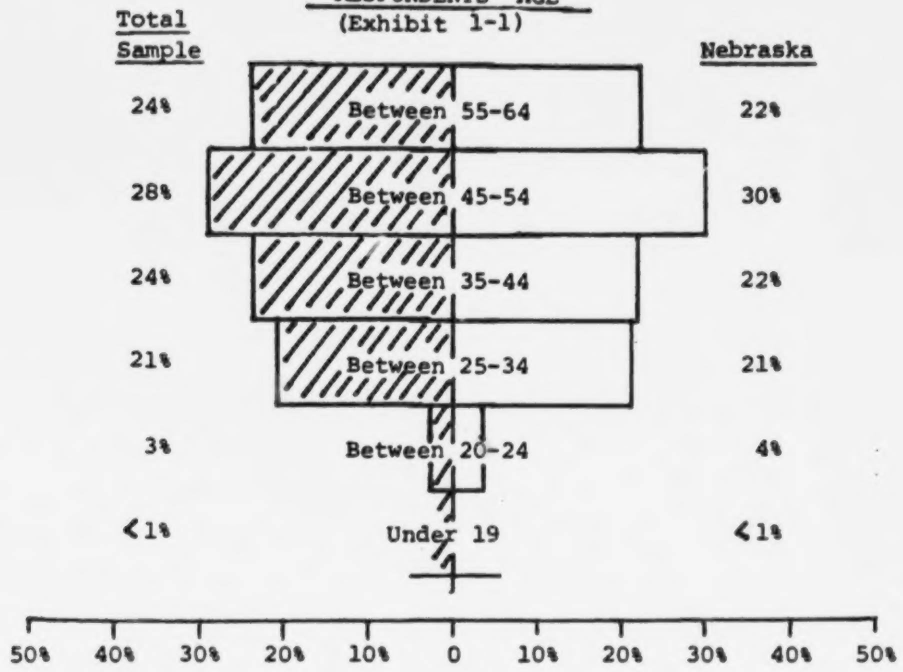
There were 407 private pesticide applicators who responded to the telephone questionnaire. In general, the respondents in Nebraska were comparable, in terms of background characteristics such as age and education, with other study respondents. Exhibits 1-1 and 1-2 illustrate respondents age and education distribution. Nebraska had significantly greater numbers of respondents who reported being high school graduates than in the sample as a whole, but the total number of Nebraska respondents reporting having at least a high school diploma is comparable with the overall study averages (i.e. 84% of the Nebraska respondents and 80% of the study respondents reported having at least a high school education.)

Nearly a third of the Nebraska respondents were 45-54 years of age. The remainder of the sample was distributed relatively evenly between the age brackets of 25-44 years of age and 55-64 years of age. Less than 1% of the respondents reported being between 20-24 years of age. This age distribution is comparable with the average among other study respondents. As will be pointed out in subsequent sections of the analysis, neither age nor education correlates significantly with the reported impacts of training in Nebraska.

In terms of experience using pesticides, the Nebraska respondent group had greater numbers of respondents with 11-20 years of experience using pesticides, but fewer growers with 21 years or more of experience, than the study group as a whole. Exhibit 1-3 highlights that 72% of the growers in Nebraska report having over 10 years of experience in handling pesticides. Generally, however, the more experienced growers reported being neither more nor less influenced by the training than the inexperienced (i.e. less than 10 years growing). The correlations between years of experience using pesticides and the relative impacts of training on a variety of pesticide handling and use behavioral practices will be further analyzed in subsequent sections.

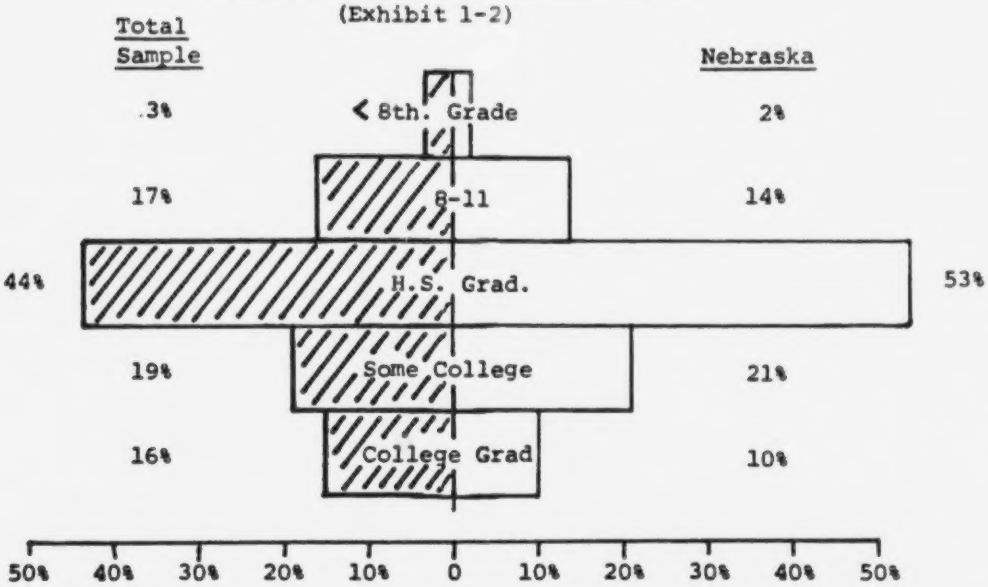
RESPONDENTS' AGE

(Exhibit 1-1)



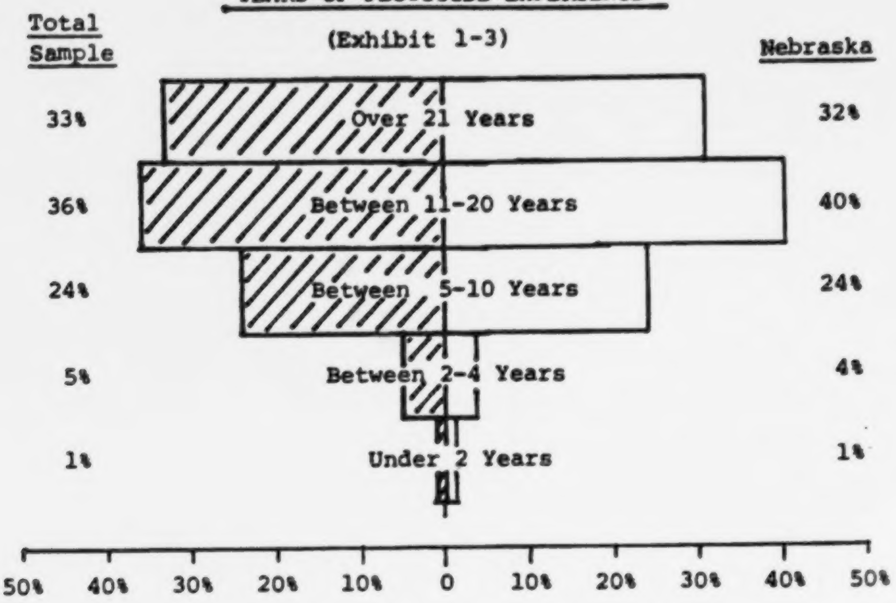
LAST YEAR OF SCHOOL COMPLETED

(Exhibit 1-2)



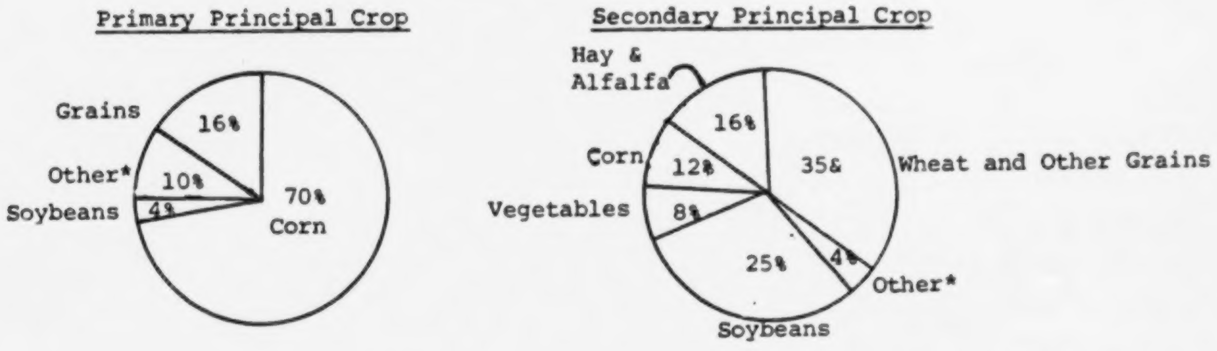
YEARS OF PESTICIDE EXPERIENCE

(Exhibit 1-3)



PRINCIPAL CROPS

(Exhibit 1-4)



*Other includes: vegetables, hay and alfalfa

*Other includes: Grass and animals

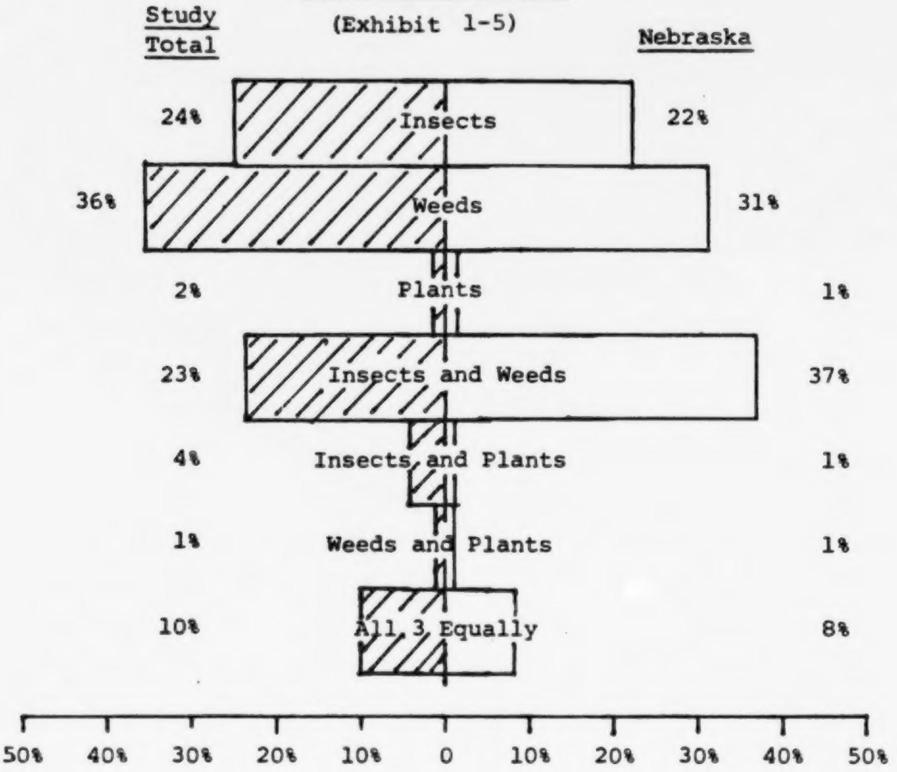
Exhibits 1-4 and 1-5 display the principal crops and principal pests of Nebraska's respondent growers. The principal crops have been displayed to highlight the most important crop mentioned first by the grower--Primary Principal Crop--and then the second principal crop mentioned--Secondary Principal Crop.

The overwhelming primary principal crop in Nebraska is corn and the secondary principal crop is grains (mostly grain sorghum), followed by soybeans, hay and alfalfa. Grain Sorghum is one of the few crops in Nebraska which requires frequent application of a restricted use pesticide. The major use of pesticides reported by Nebraska growers is for the purpose of controlling a combination of insects and weeds (37%). Another 31% indicated that they use pesticides to control mostly weeds, and 22% said the principal pest was insects. A very small percentage of Nebraska growers reported using pesticides to control plant diseases.

The strongest distinctions between Nebraska growers and other respondents in the sample are in the areas of acres farmed, applications per year of pesticides, and dollars spent per year on pesticides. As a large corn and wheat producing state, it is not surprising that Nebraska has a significantly higher percentage of growers with farms in the 100-500 acre and over-500-acre categories. As Exhibit 1-6 illustrates, only 5% of the Nebraska growers reported farming 100 acres or less compared to 28% for the growers in the study sample as a whole. In view of the size of the farms in Nebraska and the nature of the crop-pest problem, it is understandable that Nebraska growers spend considerably more on pesticides--but need to apply less frequently--than other states in the sample. As Exhibits 1-7 and 1-8 indicate, only 18% of the Nebraska growers apply pesticides six times a year or more (compared to 31% of the sample). Nonetheless, 26% of the Nebraska growers use pesticides once a year or less compared to a slightly larger 30% for the sample. In part, this distribution and variation from the sample as a whole can be attributed to the type of pest being controlled.

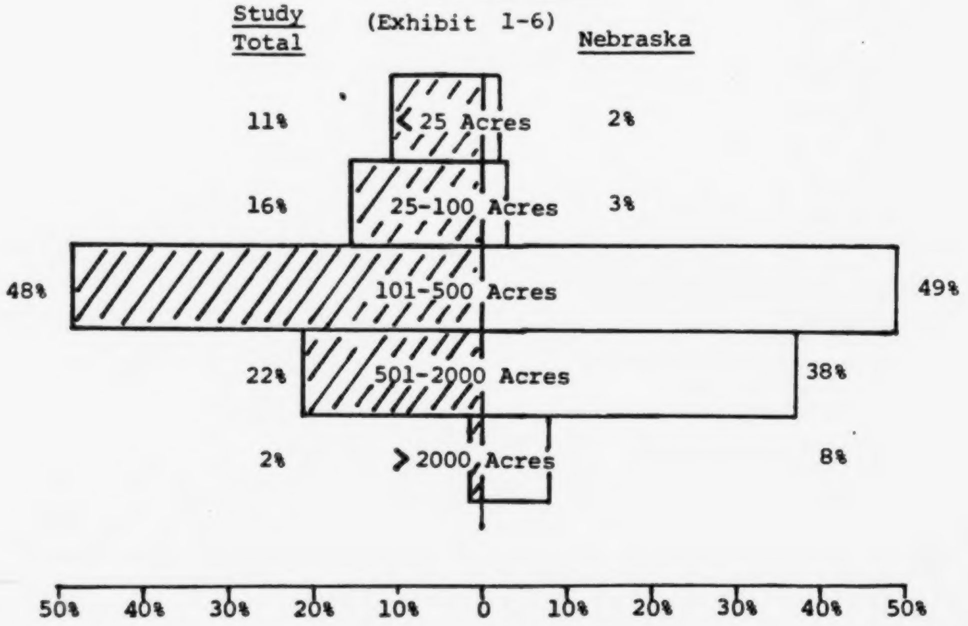
PRINCIPAL PESTS

(Exhibit 1-5)



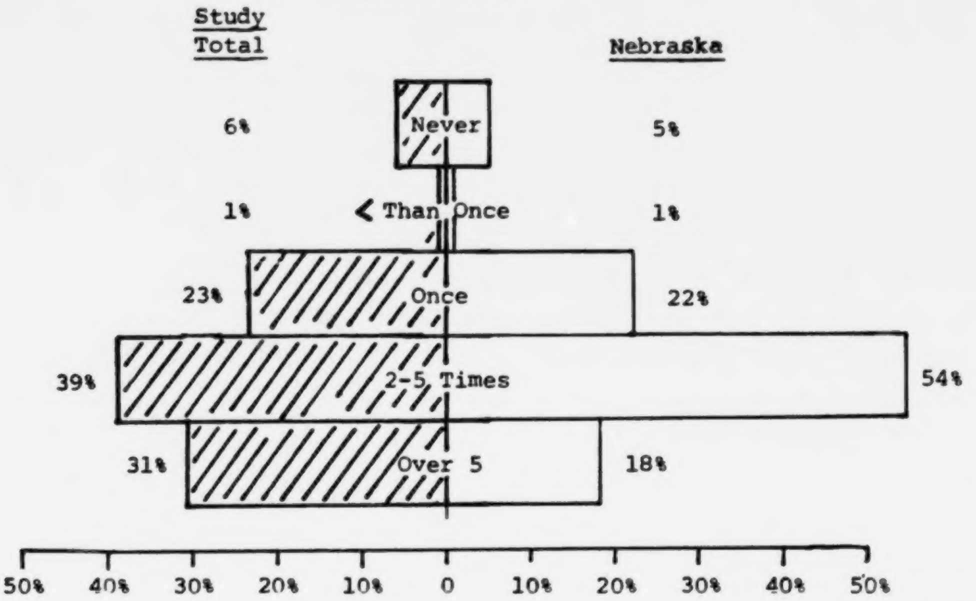
ACRES FARMED

(Exhibit 1-6)



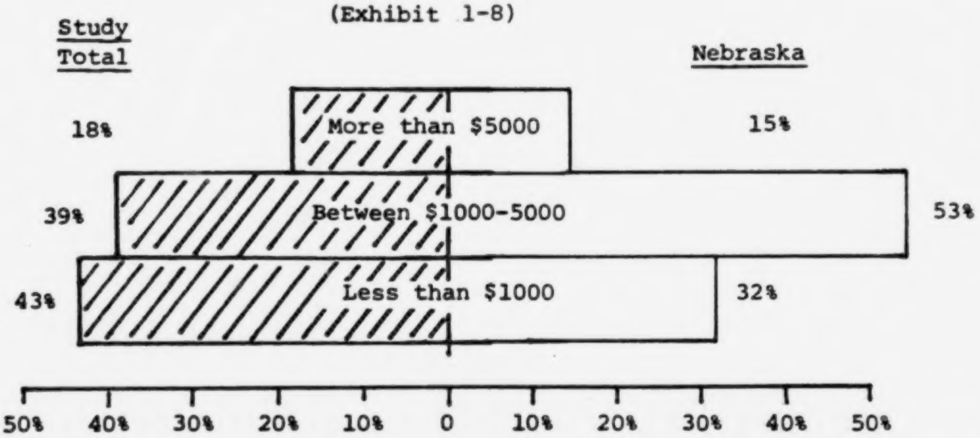
PESTICIDE APPLICATIONS PER YEAR

(Exhibit 1-7)



PESTICIDE EXPENDITURES LAST YEAR

(Exhibit 1-8)



Some 68% of Nebraska growers reported spending over $1000 last year on pesticides, while this was true for only 57% of the study sample. Only 15% of the Nebraska growers spend more than $5000 per year, however, compared to 18% of the sample as a whole. Therefore, a significant spending variance exists when the percentages of respondents who spend between $1000 and $5000 are compared. Some 53% of the Nebraska growers fall into this category as compared to only 39% for the total sample.

In sum, Nebraska growers are largely comparable to other study respondents except the larger size farms and the corresponding higher percentage who spend annually between $1000 and $5000 per year on pesticides which is reflective of the greater acreage. These distinctions are generally also true for Iowa, and the two states together provide the overall study with a useful baseline comparison of differences between the Midwestern states and Eastern states with respect to pesticide use practices. In the following section the Nebraska Private Applicator Training and Certification Program is described and analyzed in terms of training program characteristics.

2.0 ANALYSIS OF TRAINING PROGRAM CHARACTERISTICS

2.1 Program Description and Overall Assessment

Nebraska requires participation in a basic training course as a prerequisite to certification. No examination is required, and certification is virtually automatic upon the filing of a certification application signed by the County Agent who conducted the training. No fee is charged. There is a self-study option coupled with an examination available, but it is rarely chosen. Nebraska and Colorado are the only states in the nation whose certification programs are administered by the Environmental Protection Agency (EPA). The EPA Regional Office in Kansas City is responsible for issuing certification credentials and enforcing the law and the regulations. Nebraska is divided into five districts, each of which is supervised by an Extension Pesticide Training Coordinator.

The training and certification process is jointly conducted by the EPA and the State through the Cooperative Extension Service (CES). The CES, headquartered at the University of Nebraska in Lincoln, is responsible for establishing and maintaining the training, and reviewing and updating materials.

Training sessions were conducted at an average of ten sites in each county for a total of approximately 830 sites in the state. Each group session includes a presentation of the Colorado Slide/Tape Series supplemented by the EPA Core Manual for review and discussion. In addition, the state has developed its own Workbook to highlight the slide/tape series. Further, about 20% of the county agents who administer the training use an exercise in calibration methods. This exercise is not formalized but, rather, its presentation varies depending on the agent's perception of the growers' needs. Each county agent has the latitude to devote more time to the pest(s) most prevalent in his respective county, and programs on local pest identification are often included.

In 1981 the Slide/Tape Series and Workbook have been updated to reflect changes in law, calibration methods, pesticides safety, and application equipment. Each of these individual training elements will be analyzed in Section 2.3. In general, the training emphasizes the topics of calibration, storage, and disposal.

In order to determine where a grower would be most likely to go to obtain information about pesticides (specifically, if not sure about how to use a pesticide or which pesticide to use), each grower was asked to identify where he would be most likely to go for help. This open-ended question--responses by growers were recorded as provided--was coded into the following categories:

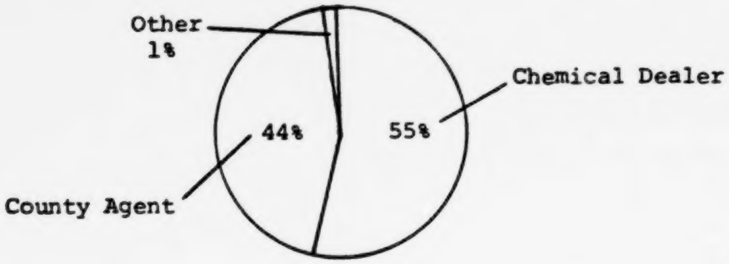
- neighbor or relative
- chemical dealer, supplier, or company sales representative
- state department or agriculture official
- vocational agriculture teacher
- farm magazines and publications
- other

Exhibit 2-1 indicates that 55% of the respondents reported that they were most likely to go to their chemical dealer or equivalent, while 44% were most likely to utilize the services of the county extension agent. In the study sample as a whole, a more modest 47% of the respondents reported reliance on the chemical dealer or equivalent as the most likely source of pesticide assistance. The reliance on chemical dealers is illustrative of the important role of the dealer associations and agricultural cooperatives in providing information to growers. In Nebraska an extensive network of chemical dealer associations and agricultural cooperatives provides information to growers concerning pest identification, pest selection and pesticide use and the Cooperative Extension Service conducts an annual training which includes chemical dealer representatives. Many of the dealers utilize a system of computers which the growers can use to match the proper pesticide with the identified pest problem. These systems include data on proper techniques for pesticide application.

One potential indicator of the degree of satisfaction that the grower has with the usefulness of training sessions (e.g., in providing information on how to select and/or use a pesticide) is the overall rating of training. Exhibit 2-2 compares the rating of Nebraska growers to the overall study total on the issue of how worthwhile the growers found the state private applicator training program to be; i.e. "very

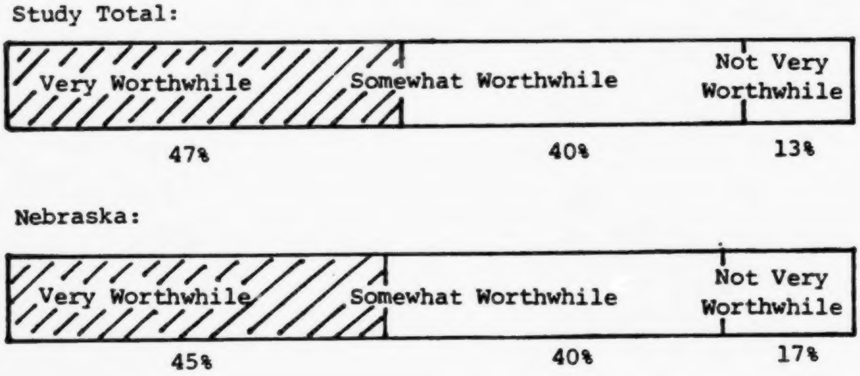
SOURCE OF PESTICIDE ASSISTANCE

(Exhibit 2-1)



PERCEIVED WORTH OF TRAINING

(Exhibit 2-2)



worthwhile," "somewhat worthwhile," or "not very worthwhile." A slightly smaller percentage of Nebraska growers found the training to be very worthwhile (45%), although a slightly higher percentage found it to be somewhat worthwhile than the study as a whole. A somewhat higher number of Nebraska growers also rated the overall worth of the training as not very worthwhile (15%); in fact, 2% higher than the study average and the second highest negative overall rating of the training of the five states in the study.

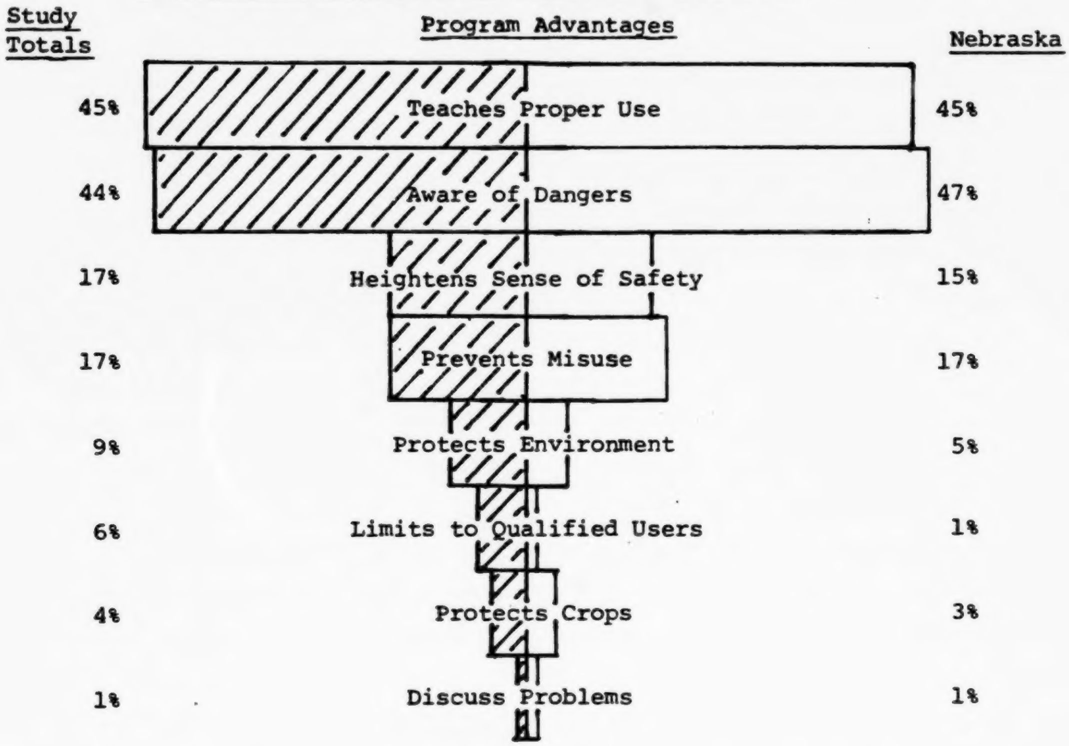
The apparent lack of enthusiasm for the worth of the training in Nebraska (fired, in part, by the negative publicity aroused by the political battle between 1975-1978 among the Nebraska legislature, EPA, and the Nebraska Department of Agriculture), coupled with the significant number of Nebraska applicators who prefer to go to their dealer or equivalent (rather than the county extension agent) for advice in pesticide use, can be further investigated by considering some of the specific advantages and disadvantages of the Private Pesticide Applicator Training and Certification Program, as reported by Nebraska respondents. These are examined below.

2.2 Advantages and Disadvantages of the Program

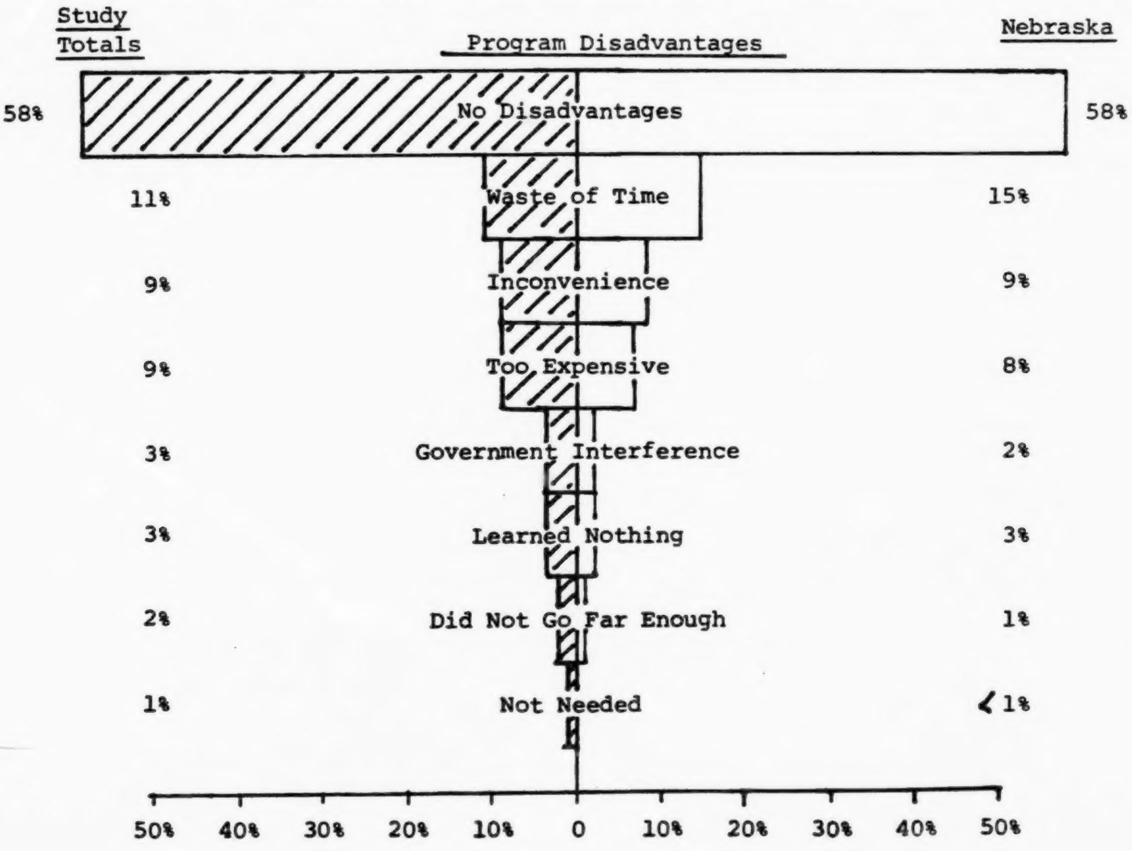
Respondents were asked to describe what they thought the advantages of having a state private applicator training and certification program were. Then they were asked to describe their perceived disadvantages. The open-ended nature of the question tends to strengthen the importance of each of the responses to this series of questions, a display of which is provided in Exhibit 2-3.

In terms of program advantages, the largest percentage of responses (63%) cited the fact that the program teaches proper use, how to prevent misuse, and limits use (of pesticides) to qualified people only. Nearly as many (61%) identified "creates awareness of the dangers and the need for safety precautions" as a program advantage. These two figures are comparable to figures for the study as a whole (68% and 61% respectively, see Exhibit 2-3). These findings support the view that

ADVANTAGES AND DISADVANTAGES OF THE STATE PRIVATE APPLICATOR TRAINING AND CERTIFICATION PROGRAM (Exhibit 2-3)*



*(Note: Percentages in this exhibit need not total 100%)



Nebraska growers regard the program as offering particular advantages when it comes to personal safety awareness and related behaviors. Nebraska applicators cited advantages associated with the protection of crops, livestock or the environment even less frequently than did the study as a whole.

In terms of disadvantages, 58% of the responses voluntary cited "no disadvantages," and this was identical to the study total. More interesting are the specific disadvantages cited by those who believed the program to have disadvantages (see Exhibit 2-3). About 24% of the respondents felt that the program was either a waste of time or too expensive. In part, this strong reaction in Nebraska (only 20% fell into these categories for the study as a whole) may be a reflection of the perceived lack of utility of a training and certification program in a state where many pesticides are not restricted and where information on their use is readily available from both county agents and chemical dealers. Nebraska was similar to the study as a whole in the percentage of growers who cited both "considered too expensive and involving too much government interference" (10% and 11%) and "considered too simple, irrelevant to the job, and not teaching anything new" (5% and 5%).

In many respects the nature of the farming practices and related pesticide use practices in Nebraska are shared by Iowa, and these two Midwestern states were both characterized by growers as offering training programs which are irrelevant and a waste of time. To no small degree, the grower frustration is related to the absence of need for and use of restricted pesticides by the majority of Midwest farmers and the practicality of the training and certification requirements for meeting those needs. In the following section, specific components of the training are examined in terms of grower assessment of their perceived value to his needs.

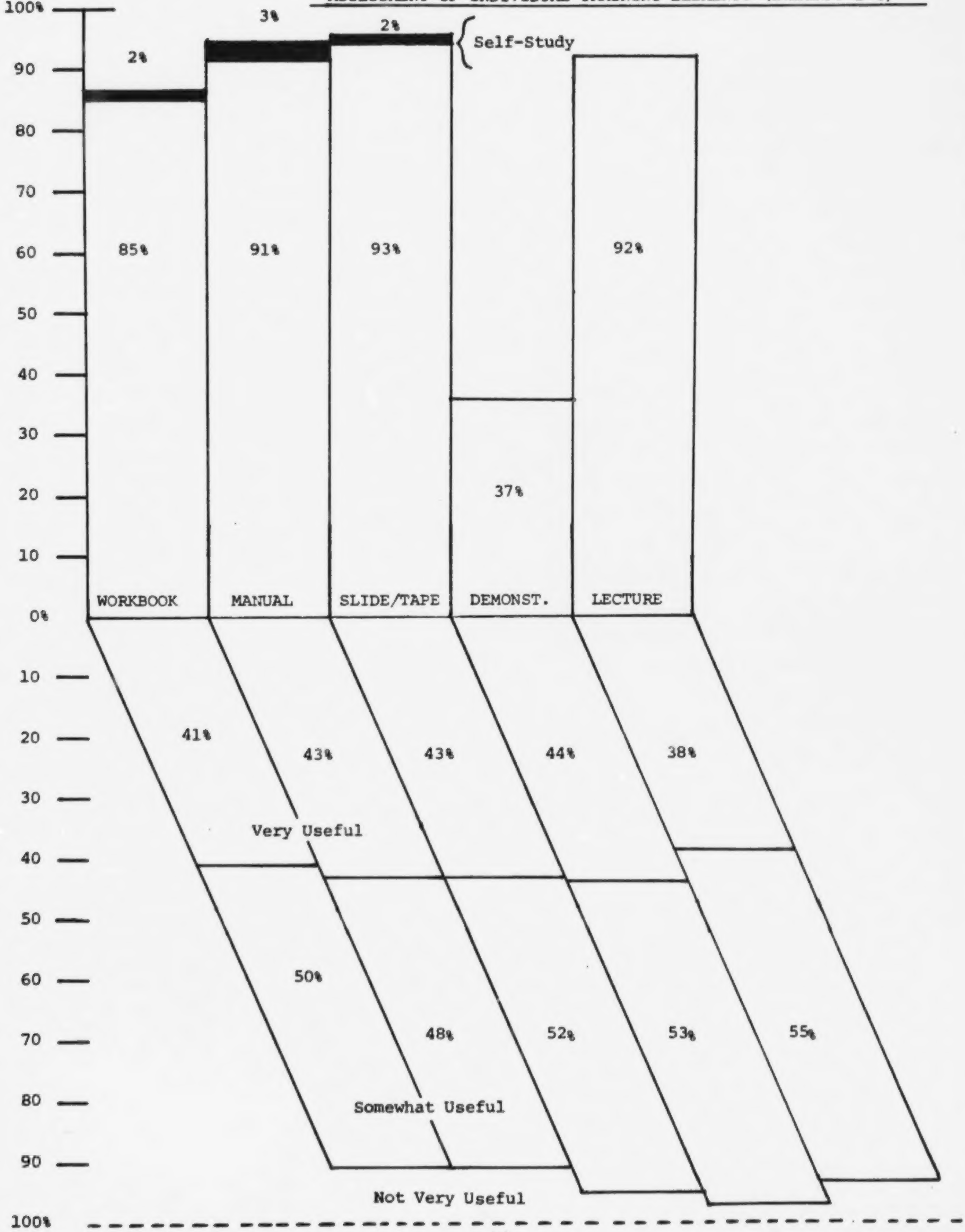
2.3 Assessment of Individual Training Elements

In order to determine whether or not particular aspects of the training program were perceived by the grower as having greater or lesser value than others, growers were asked to indicate whether or not their training sessions included any of the following items: (1) slide/tape program; (2) film or videotape; (3) demonstration program; (4) lecture; (5) training manual; and (6) workbook. For each item which the grower indicated he had during training, he was immediately asked to indicate whether he found the particular item to be "very useful," "somewhat useful," or "not very useful." An identical series of questions (omitting demonstrations and lectures) were asked of the 2% of Nebraska respondents who indicated they received their training by self-study. Since the Nebraska Private Applicator Training and Certification Program does not include a film, the analysis which follows necessarily focuses only on the growers' assessment of the slide/tape series, the demonstrations, the lectures, the workbook, and the training manuals.

Exhibit 2-4 displays these four training methods. The bar at the top illustrates the total number of respondents who indicated that they received each method, and whether by training session or self-study. The bars on the bottom of the exhibit display the usefulness ratings for each of the methods reported received and assessed by the growers.

As Exhibit 2-4 illustrates, over 90% of the growers reported having used the slide/tape series, received lectures, and/or received a manual during the training. The remainder of the respondents either did not know whether they had received one of these methods (i.e. they had forgotten) or the category was not applicable to them (e.g. self-study respondents did not receive lectures). Because of the small number of respondents reporting self-study, their assessment of methods is aggregated with the training session group. About one out of every three growers experienced some type of demonstration during training, and typically in Nebraska this would have been a demonstration on calibration.

ASSESSMENT OF INDIVIDUAL TRAINING ELEMENTS (Exhibit 2-4)



Relatively little variation in perceived usefulness was reported among the five categories of methods, with 38%-44% of Nebraska respondents reporting them as being very useful. In each of the categories no more than 9% of the respondents found any one training element not very useful. The assessed usefulness of the five training elements are not significantly different, and are comparable to one another in terms of whether perceived as very useful, somewhat useful, or not very useful.

When compared to the overall averages for the study group, Nebraska growers rated the usefulness of the manual somewhat less favorably than the study total (56% for the study compared to 43% in Nebraska rating it as very useful). With respect to the slide/tape method, only slightly fewer Nebraska respondents found this method very useful, although slightly greater numbers of Nebraska growers found the slide/tape method to be at least somewhat useful. Significant differences are noted when comparing the respondents' ratings of the demonstrations and lectures. In the study as a whole, 53% of the respondents found demonstrations to be very useful; in Nebraska only 44% found demonstrations to be very useful. With respect to lectures, 47% of the study respondents and only 38% of Nebraska respondents, found the lectures to be "very useful;" in fact, nearly 7% of the Iowa respondents reported that they found the lectures and the demonstrations to be not very useful. In view of the importance of lectures and demonstrations in Nebraska training sessions, the relatively low rating by the Iowa growers is disappointing when compared to the higher ratings reported by respondents in most of the other states.

2.4 Initial Certification and Assessment of Certification

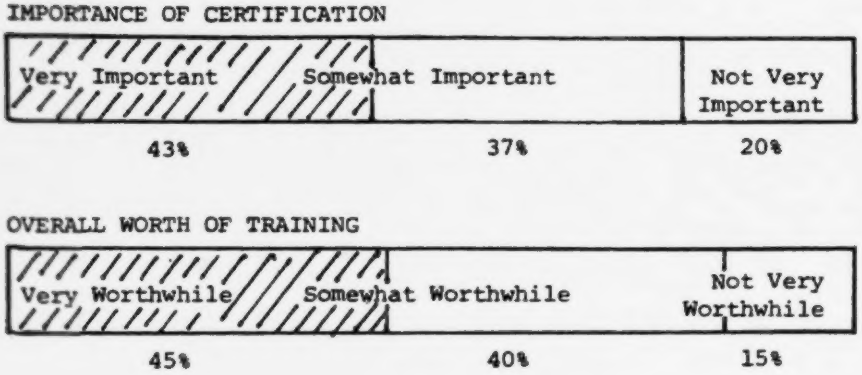
In order to distinguish the possible difference between the overall perceived value of training from the overall perceived importance of requiring pesticide certification for private applicators, growers were asked to indicate how important they felt it is for Nebraska to have a restricted pesticide certification program for private applicators, using a rating scale of very important, somewhat important, and not very important.

For purposes of comparison, Exhibit 2-5 displays the Nebraska growers' rating of the importance of certification alongside the growers' overall rating of the worth of training. Nearly 20% of the respondents indicated that certification was not very important, while 15% indicated that training was not very worthwhile. A slightly lower percentage of respondents found certification to be very important (43%) than found training very worthwhile (45%). These percentages are very similar to those of the full study sample. Given the frequent perceived lack of need for certification in Nebraska because of the crops grown and the pesticides used, the fact that Nebraska growers felt more negatively about the importance of certification than all other states in the sample except Iowa is not surprising.

Exhibit 2-6 displays the cycles in which Nebraska growers were initially certified along with the recertification cycles anticipated by certification expiration. Respondents were asked to indicate the year in which they first received their state private applicators' certifications and the year in which their initial certifications are expected to expire. Twenty percent (20%) of the respondents indicated that they did not know when they received their initial certification and only 3% reported not knowing when their certification expires. Exhibit 2-6 displays adjusted frequencies and cumulative frequencies for initial certification and year of certification expiration in order to permit an examination of the historic trends in certification and consideration of the expected demands for recertification among Nebraska growers.

The largest percentage of growers were initially certified in Nebraska during 1978, and once completed, this cycle represented the training and certification of approximately 80% of the respondent growers who eventually became certified. Eighty-three percent of the respondents reported that they expect their certification to expire during 1981, following the lapse of three years for which the certification is valid. The graph on the bottom of Exhibit 2-6 displays the peaks for both

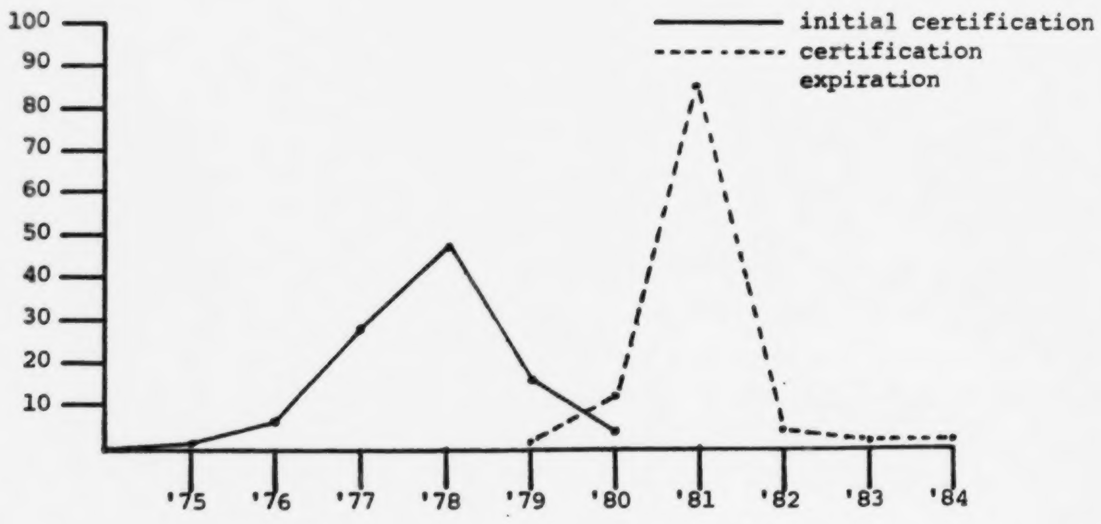
PERCEIVED IMPORTANCE OF CERTIFICATION AND OVERALL WORTH OF TRAINING (Exhibit 2-5)



(Exhibit (2-6)

YEAR OF INITIAL CERTIFICATION	
1975:	1%
1976:	5%
1977:	28%
1978:	48%
1979:	15%
1980:	3%

YEAR OF CERTIFICATION EXPIRATION	
1979:	1%
1980:	11%
1981:	83%
1982:	3%
1983:	1%
1984:	1%



certification and recertification, and indicates that Nebraska had already recertified about 35% of the growers by the end of 1980, a cycle which is well ahead of the other states. In the early years of 1975 and 1976, Nebraska was providing training and certification to growers at an accelerated pace when compared to most other states in the sample, except Iowa.

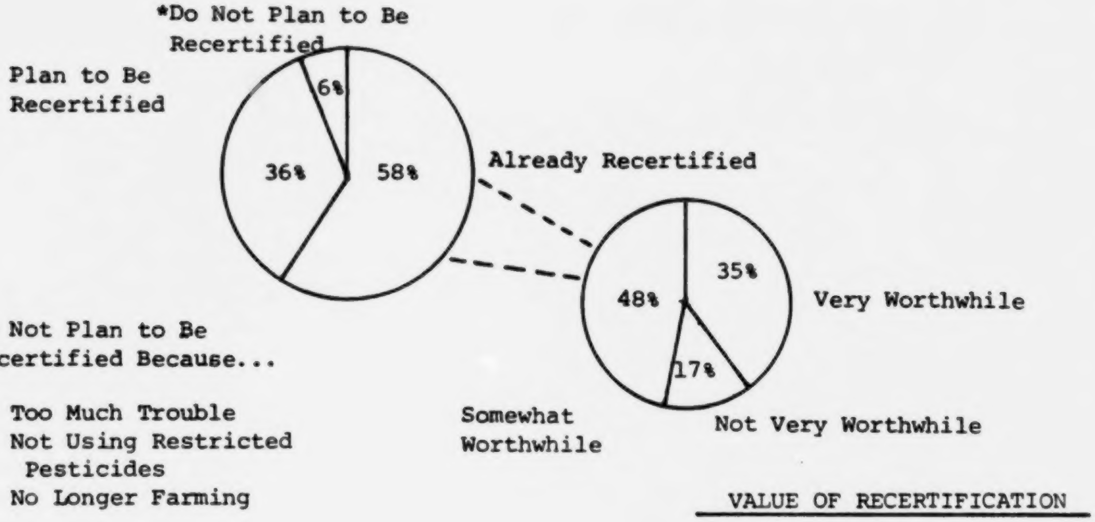
2.5 Recertification Status and Assessment of Recertification

Growers were asked to indicate whether or not they planned to become recertified. Exhibit 2-7 illustrates that only 36% of the Nebraska growers plan to be recertified, and the graph reveals that 58% of the growers in Nebraska already are recertified. Only 9% of the Nebraska growers indicated that they planned not to be recertified or had not yet decided. The number who do not plan to be recertified in Nebraska (6%) is comparable to the percentage for the study as a whole (9%).

When asked why they did not plan to become recertified, respondents voluntarily cited three main reasons (although the vast majority of respondents provided no specific reasons at all): too much trouble or offered nothing new; not using restricted pesticides; and no longer farming. Although an extremely small percentage of respondents provided reasons for not recertifying, these specific reasons may provide some insights as to why some Nebraska applicators do not plan to be recertified. The responses are about the same as those received for Iowa where the growers express an equal degree of frustration over the perceived absence of a need for training and certification.

In order to develop a sense of the overall value of the recertification program, recertified growers were asked to assess whether or not the recertification program was very worthwhile, somewhat worthwhile or not very worthwhile. For those 58% of growers who did indicate that they had already been recertified, approximately one-third found it to be very worthwhile, about one-half found it to be somewhat worthwhile while the remainder (17%) found it to be not very worthwhile. These figures can be compared to the figures presented in Exhibit 2-5 concerning the perceived value of the initial training.

RECERTIFICATION PLANS (Exhibit 2-7)



*Do Not Plan to Be Recertified Because...

1) Too Much Trouble
2) Not Using Restricted Pesticides
3) No Longer Farming

2.6 Training Assessment by Background Characteristics

In order to determine whether or not particular respondents reported training being more or less worthwhile than others, the background characteristics of the Nebraska growers were examined in light of their overall assessment of training worth. Spearman nonparametric correlation coefficients were computed, and the correlations for Nebraska and the study group as a whole (which are statistically significant at the 95% confidence level) are displayed below:

Background Characteristics	Nebraska	Study Total
• number of acres farmed	a	-.16
• last year of school completed	a	-.05
• age	.12	.09
• years of pesticide experience	a	-.04
• spent on pesticides last year	a	-.14
• training or self-study	a	a

[a] Indicates correlation is not statistically significant at the .05 level.

The only correlation of interest found in Nebraska is a weak association between age of growers and training assessment. Older growers tended to rate the training as more worthwhile than did younger growers. In the study as a whole, but not in Nebraska, growers with smaller farms, with less formal education and with fewer years of using pesticides tended to rate the training as being more worthwhile than did others. Also found in the study as a whole but not in Nebraska was a mild correlation between amount spent on pesticides the previous year and rating of the training; those who spent less tended to find it more worthwhile than did others. No significant relationship was found between those who received self-study and those who received a formal training session in either Nebraska or in the whole study, although the statistical significance of this finding in Nebraska is suspect because of the small number of growers in Nebraska who chose self-study.

Of generally greater interest is the relationship between background characteristics and reported behavioral impacts. The analysis of the reported behavioral impacts for Nebraska respondents is described in detail in the following section of this report.

3.0 ANALYSIS OF BEHAVIORAL CHARACTERISTICS

For the 94% of the respondent growers in Nebraska who reported using pesticides within the last three years to control insects, weeds, or plant diseases, a series of questions was asked to determine the perceived impacts of training in eleven pesticide-related grower behaviors:

—amount of crop damage allowed
--methods of pesticide transportation
--clothing worn while mixing and loading
—clothing worn while spraying
--methods of equipment calibration
—methods of spray drift prevention
—methods of handling spills
--methods of handling leftovers
—methods of pesticide container disposal
--methods of pesticide and equipment storage

These eleven pesticide handling practices correspond to those activities which are stressed in the EPA core manual, the workbook, exercise, and other materials in Nebraska's training program. For example, training topics emphasized in Nebraska include: calibration, handling of leftover pesticides, storage, and container disposal.

As described in Section 4.3, the Comprehensive Evaluation, the specific wording of the behavioral questions consisted of a "yes or no" impact question followed by an open-ended request for specific differences since training, for impacted growers, or specific practices before training, for nonimpacted growers. In Section 3.1 below, the reported impacts of training on Nebraska growers' behaviors are examined. In subsequent subsections, each of the eleven behavioral areas is analyzed for potential reported impacts by respondents. In Section 3.2 the background characteristics of grower respondents are related to perceived impacts of training, and in Section 3.3 several key training variables are analyzed in relation to reported behavioral impacts.

Finally, in Section 3.4 an analysis is provided of those respondents who perceived no impact of training on given pesticide handling practices. In that section we focus particularly on whether or not those growers who reported being unaffected by training in some behaviors were employing generally acceptable methods of handling restricted pesticides prior to training.

3.1 Reported Behavioral Impacts

One way of obtaining an overview of the extent to which Nebraska respondent growers were influenced by training is to consider the average number of behavioral practice areas where changes were reported for the study respondents as a whole as compared with those of Nebraska respondents. Exhibit 3-1 displays the number of respondents in Nebraska, and in the study total, who reported no impacts of training along with those who reported from 1 to 11 reported behavioral areas impacted. (It is important to keep in mind that these frequencies examine behavioral areas impacted, and that within each area there may be one or more behaviors which were influenced by training.)

As can be seen from Exhibit 3-1, 78% of Nebraska grower respondents, and 76% of the study respondents as a whole, reported being affected in at least one of the reported behavioral areas targeted by training. More than half of the Nebraska respondents (55%) reported changes in at least three of the behavioral impact areas after training; about 36% reported being affected in five or more behavioral areas.

In order to examine in which of the eleven behavioral areas the Nebraska growers perceived some impact, the percentage of Nebraska respondents and respondents for the study as a whole who perceived impacts in eleven behavioral areas is displayed in Exhibit 3-2. In six of the eleven areas, proportionately more Nebraska growers perceived behavioral impacts than was true for the sample as a whole: handling spills; handling leftovers; clothing worn while mixing and loading;

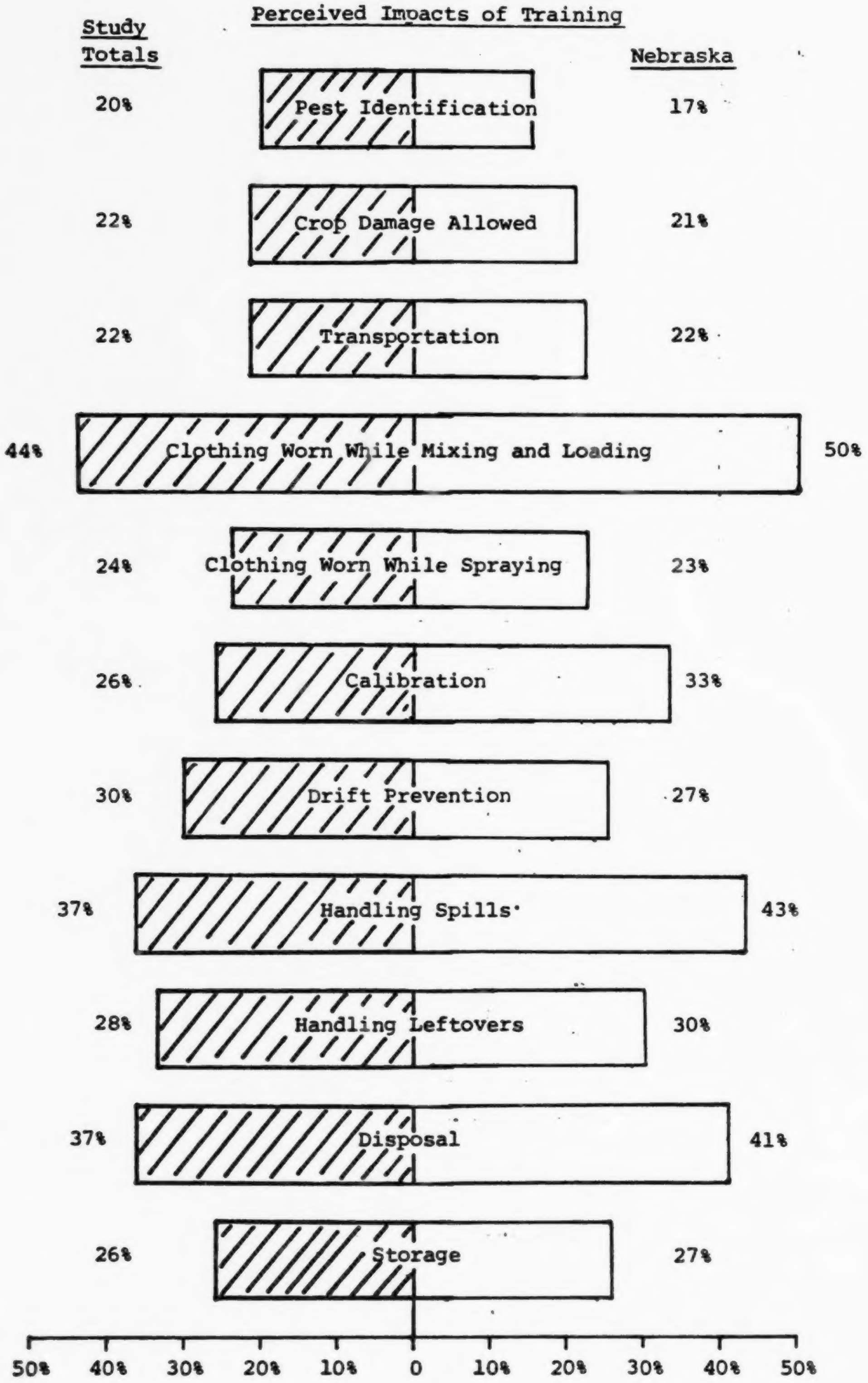
Exhibit 3-1

Number of Reported Behavioral Areas Impacted

Number of Behavioral Areas Impacted	Nebraska		Study Total	
	Relative Frequency	Cumulative Frequency	Relative Frequency	Cumulative Frequency
0	22%	22%	24%	24%
1	12	34	13	37
2	11	45	11	48
3	10	55	11	59
4	9	64	10	69
5	12	76	9	78
6	8	84	7	85
7	6	90	5	90
8	5	95	4	94
9	3	98	3	97
10	2	100	2	99
11	--	--	1	100

Exhibit 3-2

Perceived Impacts of Training



disposal; storage; and calibration. In transportation, the perceived impacts were equal for both the state and the whole sample. Only in four areas--pest identification, drift prevention, crop damage allowed, and clothing worn while spraying--were the Nebraska percentages of perceived impact lower than that of the study totals. Each of the behavioral areas is discussed in greater detail below.

3.1.1 Pest Identification and Crop Damage Allowed

Of all of the eleven areas of potential behavioral impact, pest identification was the one which recorded fewest impacts in Nebraska (17%) and in the study as a whole (20%); pest identification is stressed in the training. When asked whether or not the growers felt there had been a difference since training in the methods they use to determine what kind of pest is causing the problem, the growers reporting some difference were asked to cite specific differences. It should be noted that only a small percentage of all respondents in each state (<10%) mentioned any specific impact. The specific differences most often cited in Nebraska included those displayed below:

Pest Identification
Study Total: 20
Nebraska Respondents: 17%

better informed/identification	4
closer inspection of pests	3
check with county agent	2
better pest/pesticide matching	2
other differences (e.g., use pest management program, more judicious spraying)	5

The growers were next asked whether or not they perceived any differences since training in the amount of crop damage they allow (before spraying) in situations where they had not planned on using pesticides (note emphasis). As indicated below, Nebraska respondents (21%) and the study sample both as a whole (22%) report more changes since training in the area of crop damage allowed than changes in pest identification. When asked what specific differences the respondents experienced, 5% indicated they allow more crop damage and 7% indicated they allow less crop damage. An additional 8% reported that they are simply more aware of pesticides and more concerned (perhaps restrained) in their application of pesticides.

Crop Damage Allowed

Study Total: 22%
Nebraska Respondents: 21%

Allow more damage	5%
Allow less damage	7
Other differences	8

Nebraska farmers apply most of their pesticides before the pest infestation occurs. Preplant and preemergent pesticide applications are standard for many insects and most weeds. In these instances, no crop damage could be observed. For the types of unplanned applications to which this question is directed, the training stressed "threshold" levels of crop damage. "Threshold" is the amount of crop damage permitted before treating. It is likely that many farmers were permitting too much damage berfore treating; others may have been permitting too little damage. The training in Nebraska was designed to teach the proper level of injury at which treatment should be applied. The Nebraska respondent who states that he is showing more damage since training (5%) appears to have raised his "threshold of crop damage" since training.

3.1.2 Pesticide Transportation

When asked about differences since training in their methods of transporting pesticides, 22% of both Nebraska respondents and the full sample reported changes since training in this area. Less than 10% of the total sample of respondents mentioned any specific impact of training on their methods of pesticide transportation. Nebraska respondents reported very few specific impacts in this area as well. As indicated below, when asked for specific differences since training, most respondents simply stated that they were more careful in general.

Transportation

Study Total: 22%
Nebraska Respondents: 22%

more careful in general	10%
keep in truck bed or trunk	6
keep in closed contained	3
other differences (e.g., pesticides delivered, separate herbicides and insecticides)	6

Some 6% mentioned that they now keep the pesticides in truck bed or in the trunk of their car. Examination of the nonimpacted respondents indicates that a high percentage of Nebraska growers (93%) were properly transporting pesticides prior to taking the training.

3.1.3 Clothing Worn When Mixing and Loading Pesticides

The most substantial impact reported by all of the states in the study was in the area of differences since training in the protective clothing and equipment worn by the grower when mixing and loading pesticides that have a skull and crossbones symbol on the label. Forty-four percent of the sample reported differences since their training. Nebraska growers were slightly above the study average (50%), which is surprising since very few skull and crossbones pesticides are used in Nebraska that require protective equipment. Differences since training in clothing worn when mixing and loading represents the highest impact area for Nebraska growers. As indicated below, in terms of specific differences, the largest single impact reported for any behavior is the use of waterproof gloves while mixing and loading pesticides.

Clothing Worn When Mixing and Loading

Study Total: 44%
Nebraska Respondents: 50%

waterproof gloves	43%
waterproof boots	2
long-sleeved shirt	5
long trousers	3
goggles or glasses	24
respirator or filter mask	6
dust mask	11
hat	5
coveralls	5
raincoat or rainsuit	5
other differences	5

The second largest impact reported by the Nebraska growers was with respect to the wearing of goggles or glasses when mixing and loading pesticides with a skull and crossbones symbol on the label (24 percent).

3.1.4 Equipment Calibration

Approximately one-third of the Nebraska respondents and one-fourth of the study respondents as a whole reported differences since training in the methods by which, or frequency with which, they calibrate their application equipment. Because many of the Nebraska respondents reported applying pesticides less frequently than respondents in other states--attributable in part to the nature of the crops grown and the pest problems in Nebraska--impacts with respect to frequency of calibration are of interest. Calibration is also a topic which is emphasized by means of demonstration in the Nebraska training sessions. (Herbicides generally require careful calibration to prevent injury or ineffective weed control. It is estimated that 91% of the corn in Nebraska received an application of herbicide and 70% of an insecticide. There were 7,800,000 acres of corn grown in 1980, making calibration impacts especially profound.)

As illustrated below, 15% of those reporting being impacted since training with respect to calibration report that they are calibrating more carefully:

Calibration

Study Total: 26%
Nebraska: 33%

Specific Differences

calibrate more carefully	15%
calibrate more often	5
measure more carefully	6
follow instructions more closely	2
other differences	8

It should also be mentioned that there is an additional economic incentive to calibrate as carefully as possible given the size of the farms in Nebraska and the potential dollar savings to the farmer to apply only the amount that is needed.

3.1.5 Pesticide Spraying and Drift Prevention

Nebraska growers reported impacts as a result of training in the area of protective clothing worn during spraying almost as often as in the study as a whole (23% versus 24%). This area of impact represented the fourth lowest percentage of the eleven areas in Nebraska, a finding which may result from the fact that many of the Nebraska growers utilize granular pesticides, thereby avoiding the personal safety hazards of spraying altogether, and few pesticides used in Nebraska require the use of protective clothing. Further, much of the large-scale spraying is contracted out to commercial applicators. Specific changes in this area reported by Nebraska growers are shown below.

Clothing Worn During Spraying

Study Total: 24%
Nebraska Respodents: 23%

waterproof gloves	14%
waterproof boots	2
long-sleeved shirt	4
long trousers	1
goggles or glasses	9
respirator or filter mask	3
dust mask	4
hat	1
coveralls	5
raincoat or rainsuit	3
other differences	1

Almost the same percentage of Nebraska growers and the full sample reported changes since training in the area of drift prevention (27% and 30%, respectively). In terms of the specific differences in drift prevention since training which were reported by those impacted, Nebraska growers were comparable with overall study respondents. Specific changes in this area, as reported in Nebraska, are shown below.

Drift Prevention

Study Total: 30%
Nebraska Respondents: 27%

Spray when wind is low	17
Spray by wind direction	6
Spray at cooler times	0
Use lower pressure	3
Use larger nozzle opening	4
Use drift control agent	2
Spray closer to ground	1
Other method (e.g., not when raining)	9

3.1.6 Handling Pesticide Spills and Leftovers

When asked whether or not there was any difference since training in what the Nebraska grower would do if a small amount of undiluted pesticide were spilled on his or her skin, a substantial number of respondents (43%) said there was a difference in this area. This is slightly more than the study sample as a whole (37%). Specific types of changed behavior for Nebraska respondents are shown below.

Handling Spills

Study Total: 37%
Nebraska Respondents: 43%

Specific Differences	
Wash more quickly	14%
Wash more thoroughly	19
Remove clothing	16
More careful in general	4
More likely to read label	0
Other differences, (e.g., contact physician, keep poison control phone number)	6

A strong improvement in personal safety is reflected in these posttraining behaviors in the area of pesticide spills.

Nebraska growers also report relatively comparable effects of training on the way in which they handle leftovers. Slightly more Nebraska respondents noted changes in this area (30%) than in the full study sample (28%). Specific types of changes are reported in the following table.

Handling Leftovers

Study Total: 28%
Nebraska Respondents: 30%

Specific Differences	
Store in closed container	10%
Drain it or bury it into ground	4
Spray some field until empty	2
Dilute then spray same field	0
Apply it to another field	1
Don't have any leftover	3
Other differences, (e.g., take it to a dealer)	9

It is important to note that 4% of the Nebraska growers, as well as comparable percentages of growers in other states, reported burying the pesticide or draining it onto the ground since training, a procedure not recommended in training.

3.1.7 Pesticide Storage and Disposal

The percentages of respondents who perceived impacts on their methods of storing their pesticides and equipment varied little across the states, including Nebraska. Of the differences reported, most respondents indicated they now keep their pesticides in a special shed and away from children and animals.

Pesticide & Equipment Storage

Study Total: 26%
Nebraska Respondents: 27%

Specific Differences	
Keep them locked	9%
Keep them in special shed	12
Keep them away from children/animals	10
Wash/clean before storing	3
Store away from extreme heat	4
Other methods (e.g., take to dealer)	9

In terms of disposal of the empty pesticide containers, the reported perceived impacts across the states holds true for Nebraska as well. Of the specific behaviors reported, burying the empty containers was the strongest difference reported in Nebraska followed by burning the containers; although Nebraska still recommends burial in their training, most other states are no longer recommending this method.

It is interesting to note that in Nebraska most town dumps are licensed for pesticide and container disposal. According to the training coordinator, a response of "take (the used pesticide containers) to a dump" would have been a preferred answer and, in fact, training encourages the use of town dumps. Under these circumstances, a discouraging 2% of the respondents in Nebraska mentioned disposing of pesticide containers at the town dump as a specific behavioral difference since training; nearly one-quarter (23%) reported burying them.

Method of Container Disposal

Study Total: 37%
Nebraska Respondents: 41%

Specific Differences

Burn them	12%
Bury them	23
Rinse them	7
Crush or puncture them	7
Haul them to a landfill	7
Take them to a dump	2
Store them in a safe place awaiting disposal	0
Other methods (e.g., take them to dealer, reuse them)	4

Summary of Perceived Impacts

To summarize the perceived impacts of training on the specific behavioral practices of the Nebraska growers, the eleven behavioral practices are rank ordered below by extent of impact. For comparison purposes, the rank order of each behavioral item for the study group as a whole is also provided. Specific percentage comparison can also be referenced on Exhibit 3-2 previously presented.

Nebraska Rank Order	Study Total	Behavioral Impact Area	% of Nebraska Respondents Who Perceived Impacts Attributable to Training
1	1	Clothing Worn While Mixing & Loading	50%
2	2	Methods of Handling Spills	43
3	3	Methods of Container Disposal	41
4	6	Methods of Equipment Calibration	33
5	5	Methods of Handling Leftovers	30
6	4	Methods of Spray Drift Prevention	27
7	7	Methods of Pesticide and Equipment Storage	27
8	6	Clothing Worn While Spraying	23
9	9	Methods of Pesticide Transportation	22
10	10	Amount of Crop Damage Allowed	21
11	11	Methods of Pest Identification	17

Clearly, for both Nebraska and the study respondents as a whole, behavior pertaining to personal safety appears to be at the top of the list of affected behaviors since training. A comparison of the rank orderings reveals two variations. The first of these is the higher ranking of calibration in Nebraska than for the study as a whole, perhaps reflecting the emphasis placed on calibration in the Nebraska training. The second is the relatively lower rating given to spray drift prevention which may reflect the fact that many Nebraska (as well as Iowa) growers use more granulars than other states in the study. Nevertheless, 78% of the Nebraska respondents reported changing their behavior in at least one area since receiving the Private Applicator training.

In the following section the reported behavioral practices of the Nebraska growers are examined in light of their reported background characteristics to determine whether or not growers with particular sets of characteristics were more or less impacted by the training program.

3.2 Reported Behavioral Impacts by Background Characteristics

The Nebraska private applicators' perceptions of differences since training in their methods of handling pesticides were examined in relation to six background characteristics: age, education, years of pesticide experience, number of pesticide applications per year, and pesticide expenditures last year. This analysis helps to determine if any particular set of respondents--for example, the older or less educated--reported being more or less impacted by training in specific behavioral areas than other respondents. Spearman nonparametric correlation coefficients were computed relating each background variable to the behavioral impacts reported by each grower, and in the following paragraphs the associations which are statistically significant at the 95 percent confidence level are described.

Our discussion is organized around the six background characteristics. For each characteristic we first discuss the correlation (if any) with the total number of behavioral areas in which Nebraska growers reported changes subsequent to training as shown in Exhibit 3-3. Then we turn our attention to correlations (if any) between background characteristics and reported changes since training in specific behavioral impact areas, as summarized in Exhibit 3-4.

Respondent's Age. There was no significant association between the respondent's age and the number of reported behavioral changes since training, either in Nebraska or in any of the other states in the study. This suggests that the older growers were no more or less likely to be affected by the training than were the younger growers.

Respondent's Education. For Nebraska respondents, there also were no significant correlations between the respondent's education level and the number of behaviors reported impacted as a result of training. For the full sample, however, there was a positive correlation ($r=.06$).

Exhibit 3-3

Number of Behavioral Impact Areas with Reported Changes by Background Characteristics

	Nebraska	Total Sample
Age	a	a
Education	a	.06
Farm Size	a	-.06
Years of Pesticide Experience	a	a
Frequency of Pesticide Application	.10	.07
Pesticide Expenditures, 1980	.09	a

[a] Indicates correlations are not statistically significant at the .05 level.

Exhibit 3-4

Correlation of Reported Behavioral Impacts by Background Characteristics

	Pest Identification	Crop Damage Allowed	Transportation	Clothing While Mixing	Clothing While Spraying	Equipment Calibration	Drift Prevention	Handling Spills	Handling Leftovers	Pesticide Disposal	Pesticide Storage
Farm Size	a	a	a	a	a	a	a	-.11	a	a	a
Education	a	a	a	a	a	a	a	a	a	a	a
Age	a	a	a	a	a	a	a	a	a	a	a
Years of Pesticide Experience	a	a	a	a	a	a	a	a	a	a	a
Pesticide Usage per Year	.10	.10	a	.10	.12	a	a	a	a	a	a
Pesticide Expenditures Last Year	a	a	a	a	a	a	a	a	a	a	a

[a] indicates correlations not statistically significant at the .05 level.

Years of Experience Using Pesticides. No significant association appears in any of the states between a respondent's number of years of pesticide experience and his number of perceived impacts of training. The growers in Nebraska, and all other states, who have been using pesticides for a number of years are about as likely to be impacted by training as the grower who recently began using pesticides.

Acres Farmed. In a few of the states in the study, there were significant and negative correlations between farm size and the number of behavioral areas reporting changes since training. A mild association (r=-.11) also is observed in Nebraska, between growers with smaller farms and reported impact in the area of handling spills. Perhaps large-scale farmers are more likely to be using correct procedures for handling spills prior to training (and hence not influenced by training) than small-scale farmers. The potential relationship between absence of reported impact and acceptable pretraining behaviors will be examined more closely in Section 3.4, Reported Behavioral Practices of Non-Impacted Respondents.

Pesticide Application Per Year. In Nebraska and in the full study sample, there is a positive association (r = .10) between frequency of pesticide applications and the number of behavioral areas where there are reported changes since training. In Nebraska, the private applicator who sprays his field many times a year tended to report more differences since training in pest identification (r = .10); the amount of crop damage allowed (r = .10); and the protective gear while mixing (r = .10) and spraying (r = .12). One possible explanation is that the more frequent user of pesticides is likely to be more aware of the need for careful protection during preparation and application than is the infrequent user.

Pesticide Expenditures Last Year. In the full study sample, no significant association exists between the level of 1980 pesticide expenditures and the number of reported impacts of training on behavior. In Nebraska, there appears to be a mild, but statistically significant and positive correlation between pesticide expenditures and the number of impact areas in which changes since training are reported (r = .09). Since there are no significant associations between 1980 expenditures and changes in specific impact areas in Nebraska--and since several significant negative associations exist in the other states between expenditures and individual behavior changes--this is somewhat surprising. The existence of a statistically significant correlation between pesticides expenditures and the number of impact areas where change is reported, and not between expenditures and reported change in any specific impact area, can be explained, however, by the larger sample size for the former.

3.3 Reported Behavioral Impacts by Training Characteristics

In order to determine if there were any relationship between a few key characteristics of training and reported behavioral impacts, four training variables were examined: year of initial certification; training type (training session versus self-study); source of pesticide assistance (chemical dealer versus county agent); and overall assessment of training worth.

Our discussion of the correlations between training characteristics and reported behavioral impacts is organized the same way as the discussion of the correlation between background characteristics and reported behavioral impacts (see Section 3.2, above). For each training characteristic we first discuss the correlation (if any) with the total number of behavioral impact areas in which Nebraska growers reported changes subsequent to training, as shown in Exhibit 3-5. Then we turn our attention to correlations (if any) between training characteristics and reported changes since training in specific behavioral impact areas, as summarized in Exhibit 3-6.

Year of Initial Certification. Although it had been asserted that the growers who were trained and certified early may have benefited more from the training than those trained later (because those trained later were "reluctant" to participate) no relationship between the respondent's year of certification and number of reported impacts was found in any of the states. Those private applicators trained in Nebraska in the first training cycles perceived changes in as many behavioral impact areas as those applicators trained later. Nevertheless, there

Exhibit 3-5

Number of Behavioral Impact Areas with Reported Changes by Training Characteristics

	NEBRASKA	Total Sample
Year of Initial Certification	a	a
Training Type	.11	a
Source of Pesticide Assistance	.09	.16
Assessment of Training Worth	.30	.33

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[a] Indicates correlations are not statistically significant at the .05 level.

Exhibit 3-6

Correlation of Reported Behavioral Impacts by Training Characteristics

	Pest Identification	Crop Damage Allowed	Transportation	Clothing While Mixing	Clothing While Spraying	Equipment Calibration	Drift Prevention	Handling Spills	Handling Leftovers	Pesticide Disposal	Pesticide Storage
Year of Initial Certification	a	a	a	a	a	a	a	.11	a	a	a
Training Type	a	a	.11	a	a	a	.15	a	a	a	.15
Source of Pesticide Assistance	.09	a	.14	a	.16	a	a	.10	a	a	a
Assessment of Training Worth	.23	.12	.13	.22	.24	.11	.17	.22	.21	.23	.21

[a] Indicates correlations not statistically significant at the .05 level.

is a mild association in the full sample (r = .11) between year of certification and reported behavioral changes since training in one specific area: handling spills. A similar mild association is observed in Nebraska between growers with smaller farms and reported impacts in the area of handling spills.

Training Type. Only a small number of growers in Nebraska (2%) reported being trained by self-study. Because of the uneven distribution in the sample by training type, it is not surprising that there are no significant associations between the number of impact areas with reported changes since training and the method by which the respondent was trained, both in Nebraska and the full study sample. Mild associations do appear in Nebraska between those who report being trained by self-study and reported impacts in the areas of transportation (r = .11); drift prevention (r = .15) and pesticide storage (r = .15). These correlations are difficult to interpret, however, because of the small number of respondents involved in self-study. A special analysis of the differences between respondents trained by self-study versus respondents trained by training sessions was completed for the state of Pennsylvania (the only state in the study with sufficient numbers of self-study respondents to permit meaningful analysis). This discussion can be found in Appendix D, Pennsylvania Evaluation Report.

Assessment of Training Worth. Respondents in Nebraska, as well in the study as a whole, who perceived differences in more impact areas since training also tended to rate the training considerably more favorably than those who perceived differences in few, if any, impact areas. Nebraska showed a strong positive relationship between the total number of impact areas where change was reported and the favorable rating of training worth (r = .30). This correlation also existed between assessment of training worth and reported change in each of the eleven impact areas, as shown in Exhibit 3-6.

Source of Pesticide Assistance. Perhaps most interesting among the training-related characteristics is the issue of source of pesticide assistance. Where the grower is most likely to go for assistance in using pesticides--or deciding which pesticide to use--is illustrative of the source in which the grower has most confidence, and the source from which he derives his practical information about pesticide usage. In four of the five states in the study, the growers who stated that they would most likely go to their local county agent (as opposed to their chemical dealer) for pesticide assistance tended to be those who reported change since training in a greater number of impact areas (r = .16 for the total sample). The relationship in Nebraska is weaker (r = .09), but still statistically significant at the .95 confidence level. The respondents in Nebraska who reported going to their county agent were more likely to report changes since training in the following impact areas: pest identificaiton, transportation, clothing worn while spraying, and handling spills. Given the higher number of reported impacts among those most likely to go to their county agent for assistance, the comparatively high percentage of growers who report relying upon the chemical dealer (55%) presents an interesting dilemma for broadening the impact of training among Nebraska's growers.

3.4 Reported Behavioral Practices of Nonimpacted Respondents

For eight of the eleven pesticide handling practices/behavioral areas included in the study, respondents who perceived no impact of training were asked (in an open-ended way) to specify how they are currently performing those practices/behaviors. It is possible that a respondent may have reported no impact as a result of training because he was performing that behavior in an acceptable manner prior to training, and no change was needed. In the following paragraphs the behaviors of the Nebraska nonimpacted respondents are reported and discussed. Exhibit 3-7 summarizes the percentage of nonimpacted respondents reporting specific types of pesticide-handling practices in each of the eight areas.

Exhibit 3-7

Reported Behavioral Practices of Nonimpacted Respondents

	Nebraska (%)	Total (%)
1. Methods of Pesticide Transportation		
Bed of Truck	91	84
Trunk of Car	2	4
Truck cab/car seat	2	4
Other method (e.g., closed container)	5	2
2. Clothing Worn When Mixing and Loading		
Waterproof gloves	73	64
Waterproof boots	5	12
Long-sleeved shirt	22	25
Long trousers	12	16
Goggles or glasses	33	29
Respirator or filter mask	8	17
Dust mask	21	22
Hat	8	15
Coveralls	23	22
Raincoat or rainsuit	4	10
Other clothing	6	4
None worn/necessary	13	12
3. Clothing Worn While Spraying		
Waterproof gloves	40	40
Waterproof boots	6	12
Long-sleeved shirt	22	27
Long trousers	14	19
Goggles or glasses	18	20
Respirator or filter mask	4	15
Dust mask	8	15
Hat	13	21
Coveralls	19	23
Raincoat or rainsuit	5	11
Other clothing	6	4
None worn/necessary	32	21
4. Frequency of Calibration		
Before each application	62	46
Before every other application	8	8
Before every 3 or 4 applications	10	13
Less often	15	22
Other (once a year)	5	6

Exhibit 3-7 (continued)

Reported Behavioral Practices of Nonimpacted Respondents

	Nebraska (%)	Total (%)
5. Methods of Drift Prevention		
Spray when wind is low	81	80
Spray with wind direction	16	13
Spray during cooler times	1	4
Use lower pressure	12	10
Use larger nozzle opening	6	6
Use drift control agent	3	2
Spray closer to ground	14	11
Other method (e.g., not when raining)	18	18
No precaution taken/necessary	2	4
6. Methods of Handling Leftovers		
Drain it or bury it in ground	16	12
Leave it in applicator	3	4
Apply it to another field	8	5
Continue spraying until applicator empty	17	18
Dilute, then spray until applicator empty	0	2
Store in closed container	31	39
Don't have any leftover	18	18
Other methods (e.g., take to dealer)	22	12
7. Methods of Pesticide Disposal		
Burn them	55	37
Bury them	49	34
Rinse them	13	18
Crush or puncture them	17	14
Haul them to a landfill	11	22
Take them to a dump	12	15
Store them in a special place awaiting disposal	1	3
Other methods (e.g., take to dealer; re-use them)	8	8
8. Methods of Pesticide and Equipment Storage		
Keep them locked	9	14
Keep them in special area/shed/building	71	77
Keep them away from children/animals	13	10
Wash/clean before storing	25	24
Store away from extreme heat	7	7
Other methods (e.g., take to dealer)	11	8

Clearly, a large percentage of the nonimpacted respndents in Nebraska who reported no differences since training in the way they are transporting pesticides are carrying them appropriately: 93% report report carrying them in the bed of the truck or trunk of car. There are still 2% who report carrying them in the truck cab or car seat, but this is lower than the study average.

Nearly three-quarters of the nonimpacted respondents in Nebraska reported wearing waterproof gloves when mixing and loading pesticides, and 33% reported wearing goggles or glasses. These prevailing practices are similar to the most frequently reported practices adopted by the impacted respondents in Nebraska.

Of the nonimpacted respondents in Nebraska, 40% reported wearing waterproof gloves as the most common method of protection while spraying. To some degree, the problems associated with protection while spraying in Nebraska are mitigated by the pesticides being used, the more infrequent use of spraying (granulars being utilized), and the practice on the larger farms of contracting spraying out to commercial aerial applicators. Most interesting, however, is the percentage of respondents in Nebraska who report not wearing any protective clothing while spraying (or not needing protective clothing of any type). This may be explained by the use of chemicals such as Torodon, a restricted pesticide that is harmful to the environment, but three times safer than salt for human handling, and which requires no protective clothing during application.

When asked how frequently they calibrate equipment, the majority of nonimpacted private applicator in Nebraska (62%) indicated that they calibrated before each application, substantially higher than the percentage of nonimpacted respondents in the full sample (46%). In the larger midwest farms, calibration is especially important, since improperly adjusted equipment can be an expensive miscalculation when applying pesticides to hundred of acres. A substantial percentage of growers in Nebraska (33%) also reported being impacted in the area of calibration as a result of training -- a higher percentage than any other state in the sample.

Almost all nonimpacted growers in Nebraska and the full sample reported that they spray when the wind is low or low to the ground in order to prevent pesticide drift. In the midwestern states of Nebraska and Iowa, nonimpacted respondents also report several other drift prevention techniques, such as using low pressure (20% in Nebraska) and spraying by wind direction (16% in Nebraska).

When asked what method they use in handing leftovers, the Nebraska nonimpacted respondents answered similarly to the nonimpacted respondents as a whole. Most store the pesticide in a closed container (31%), plan not to have any leftover (18%), or continue spraying until the applicator is empty. None of the Nebraska nonimpacted respondents indicated that they dilute the pesticide and then spray until applicator is empty; only 3% indicated they leave the pesticide in the applicator.

The issue of the disposal of empty pesticide containers is a serious one in most states, and in Nebraska more respondents indicated being impacted as a result of training in this behavioral area than any other area. For the nonimpacted respondents in Nebraska, a high percentage reported burying the containers (49%) or incinerating them (55%). Only 34% and 37% respectively reported burying and burning in the overall sample.

A small percentage (9%) of the nonimpacted respondents in both Nebraska and Iowa reported keeping their pesticides locked, compared with 16-18% in the other states in the study. The size of the farms and distances between farms may reduce the risk of tampering with pesticides in the midwestern states. Of all the states in the study, fewer Nebraska respondents were impacted in the area of pesticide storage as a result of training than in any other. In all five states, including Nebraska, the most common method of pesticide equipment and pesticide storage among the nonimpacted respondents was keeping them in a special area, shed, or building. Seventy-one percent of Nebraska's nonimpacted respondents and 77% of the nonimpacted respondents in the full sample reported use of this method.

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EVALUATION OF THE PRIVATE APPLICATOR PESTICIDE TRAINING AND CERTIFICATION PROGRAM: A FIVE-STATE STUDY

APPENDIX D: Pennsylvania Evaluation Report

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Prepared by Abt Associates Inc. for the Environmental Protection Agency and the Council on Environmental Quality under Contract No. EQ9AC014, as amended. Opinions expressed herein are those of the Contractor and do not necessarily represent the official views of the sponsoring and participating federal and state agencies.

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APPENDIX D:

PENNSYLVANIA EVALUATION REPORT

Training for private pesticide applicators began on a statewide basis in Pennsylvania in 1977. By 1980, over 30,600 growers had been trained and certified as private pesticide applicators, and the state expects to add another 2,200 by the end of 1981. Approximately 75 county extension agents, supported by the staff of the Cooperative Extension Service (CES) of Pennsylvania State University, have delivered the training program. All program materials were developed by the CES, which works in partnership with the Pennsylvania Department of Agriculture, the state lead agency, to administer the state's training and certification program.

In the following section, we will describe relevant background characteristics of the study respondents in Pennsylvania. In Section 1.0 we begin our analysis of the Pennsylvania Pesticide Applicator Training and Certification Program. We will describe key characteristics of the training program and the overall assessment of the program as reported by study respondents. In subsequent subsections of Section 2.0 we will summarize perceived advantages and disadvantages of the program, plus grower assessment of individual training elements. In Section 3.0, we turn our attention to the perceived impacts of the training program in eleven different behavioral areas where changes could have been expected subsequent to training. We also analyze the correlations between perceived impacts and several of the respondents' background characteristics and training characteristics. We conclude Section 3.0 with a report on the current pesticide-related practices of the nonimpacted respondents in Pennsylvania.

One of the unique aspects of the Pennsylvania training and certification program is the widespread use of a self-study method of training. Over half of our Pennsylvania respondents reported that they had used the self-study method rather than attend a training session. This provides the opportunity to compare the results of self-study with training session. Analysis of our data on the effects of training type is presented in Section 4.0 of this state report.

1.0 ANALYSIS OF BACKGROUND CHARACTERISTICS

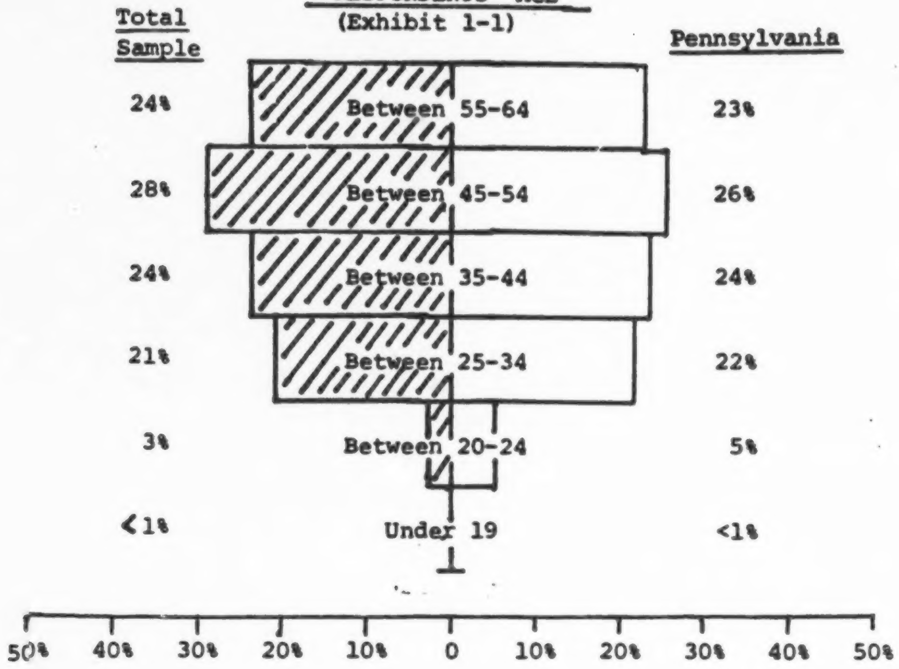
There were 413 private pesticide applicators who responded to the telephone questionnaire. In general, the respondents in Pennsylvania were about average, in terms of background characteristics such as age and education, when compared with other study respondents. Exhibits 1-1 and 1-2 illustrate the Pennsylvania respondents' age and education distribution.

The Pennsylvania respondents were evenly distributed across four age categories: 34 years and younger, 35 to 44 years, 45 to 54 years, and 55 years and over. This is almost the same as the distribution of the study as a whole, and of all five states in the survey, Pennslvania respondents most closely resembled the study sample. Pennsylvania had a slightly lower percentage of respondents who reported being at least high school graduates than the study sample as a whole (76% for Pennsylvania compared with 80% for the whole study sample). In all other respects, the Pennsylvania respondents were about the same as the study sample as a whole in terms of their formal education level.

In terms of experience using pesticides, the Pennsylvania respondents had a higher percentage of respondents with 10 years or less of pesticide experience (38%) than the study sample as a whole (31%). As shown in Exhibit 1-3, 63% of the applicators in Pennsylvania had 11 or more years of experience.

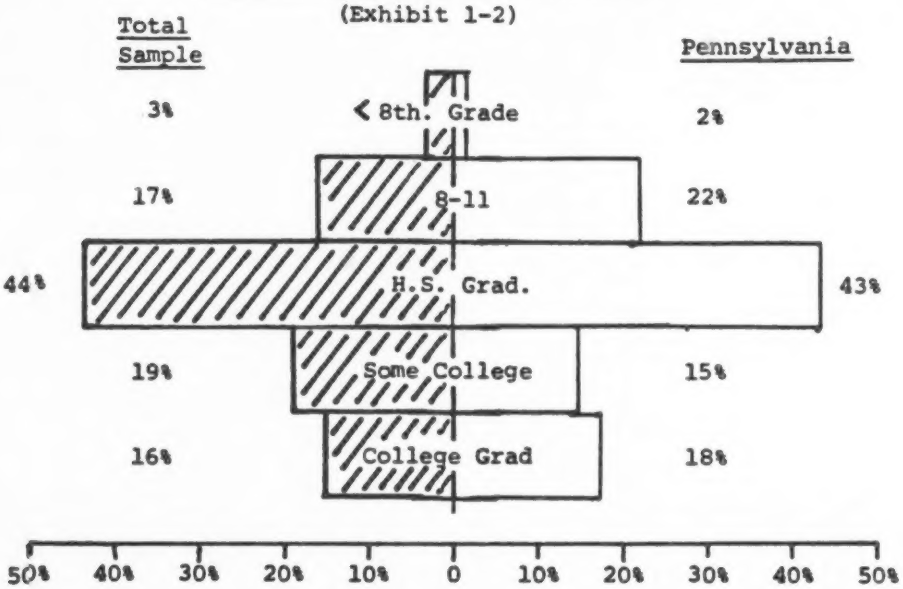
Exhibits 1-4 and 1-5 display the principal crops and principal pests for the Pennsylvania respondents. The data on principal crops have been disaggregated to show both the principal primary crop and the principal secondary crop. As shown in Exhibit 1-4, the principal primary crop in Pennsylvania is corn, followed by fruits and vegetables, and hay and alfalfa. The principal secondary crop is hay and alfalfa, followed by wheat and other grains. There also was a diversity in the purposes for which pesticides were used as shown in Exhibit 1-5. The pest reported by the largest number of respondents was weeds (36%), followed by insects (26%), and the combination of both weeds and insects (17%). Only two percent reported plant diseases as the principal pests.

RESPONDENTS' AGE
(Exhibit 1-1)



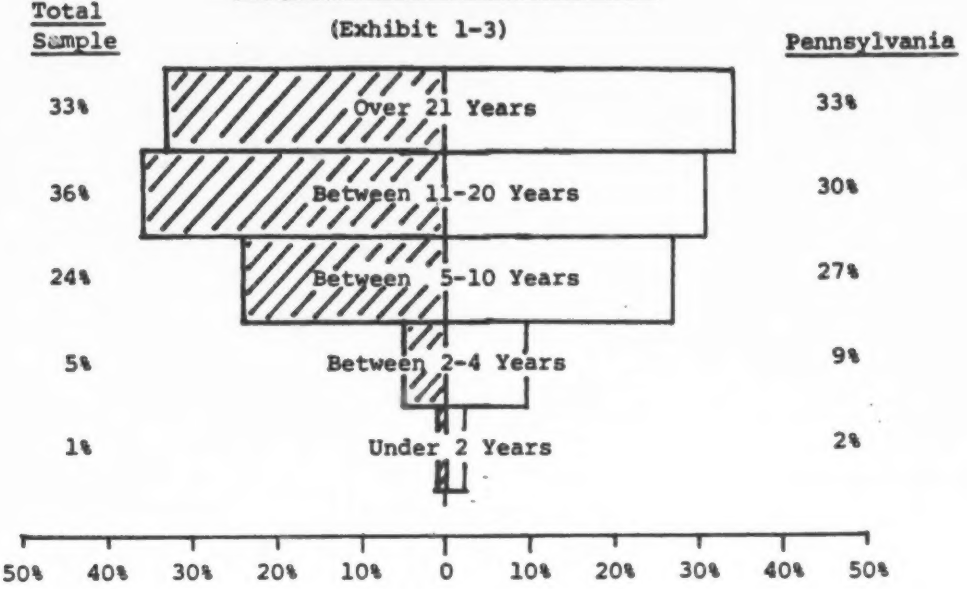
LAST YEAR OF SCHOOL COMPLETED

(Exhibit 1-2)



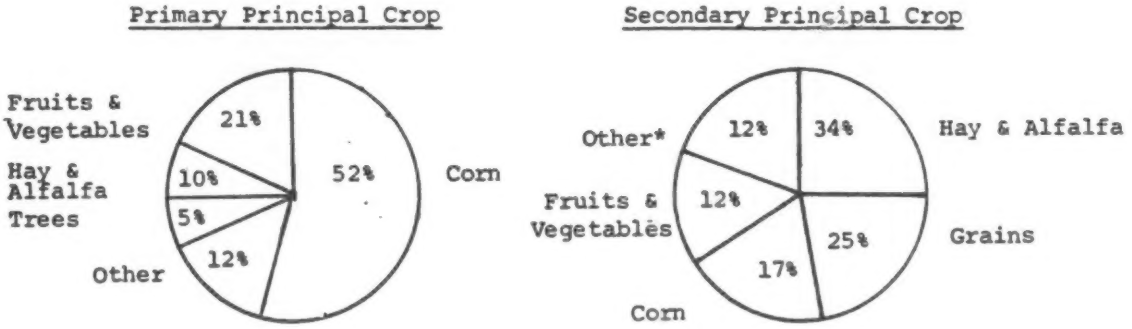
YEARS OF PESTICIDE EXPERIENCE

(Exhibit 1-3)



PRINCIPAL CROPS

(Exhibit 1-4)



*Other includes: Flowers; wheat and other grains; animals; soybeans.

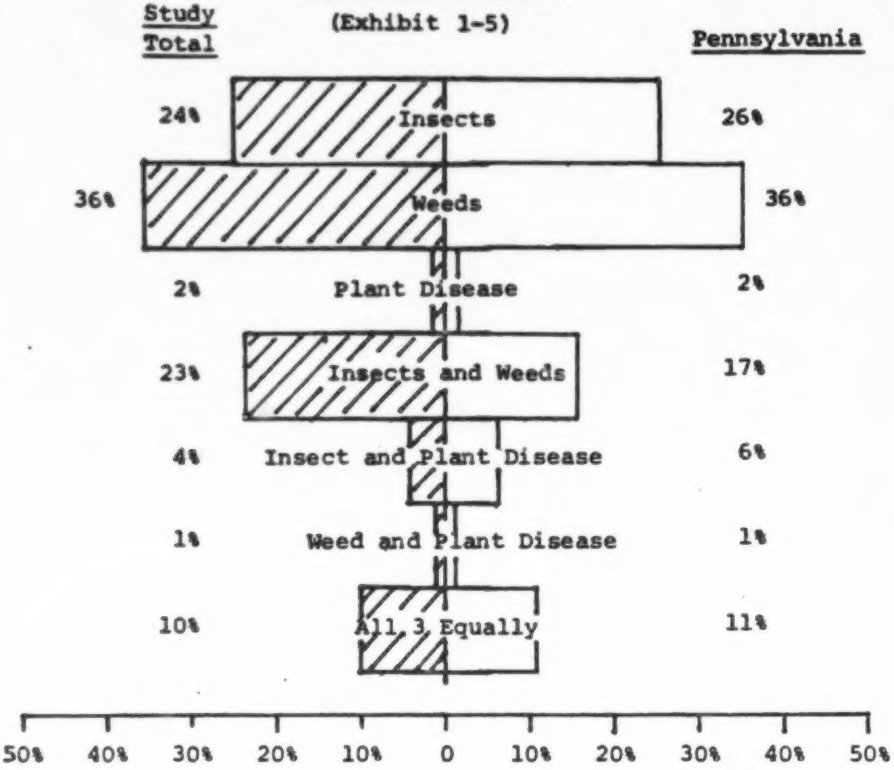
*Other includes: Soybeans and fruits.

Respondents from Pennsylvania are most different other respondents in the study sample in terms of: number of acres farmed and dollars spent on pesticides per year. Pennsylvania is a state with many small, part-time farmers and a great diversity of types of crops. Exhibit 1-6 shows that more than one-fifth (21%) of Pennsylvania's respondents farm less than 25 acres; and an additional 23% farm between 25 and 100 acres. This compares with only 28% of the study sample respondents who have farms of less than 100 acres. At the other end of the size scale, 7% of Pennsylvania respondents have farms of that size.

In terms of pesticide applications per year, Exhibit 1-7 shows that more than a third (36%) of the Pennsylvania respondents apply pesticides more than 5 times per year, and an additional 35% apply between 2 and 5 times per year. Thus, 71% of the Pennsylvania respondents apply pesticides at least twice a year or more, which is almost exactly the same as the percentage of the study sample as a whole (70%). Yet, because of the small farm size in Pennsylvania (discussed above) the Pennsylvania respondents spend substantially less on pesticides than the rest of the study sample. As shown In Exhibit 1-8, 60% of the Pennsylvania respondents spend less than $1000 per year on pesticides, and only 10% spend more than $5000. Of all five states in the study sample, Pennsylvania respondents spend the least on pesticides.

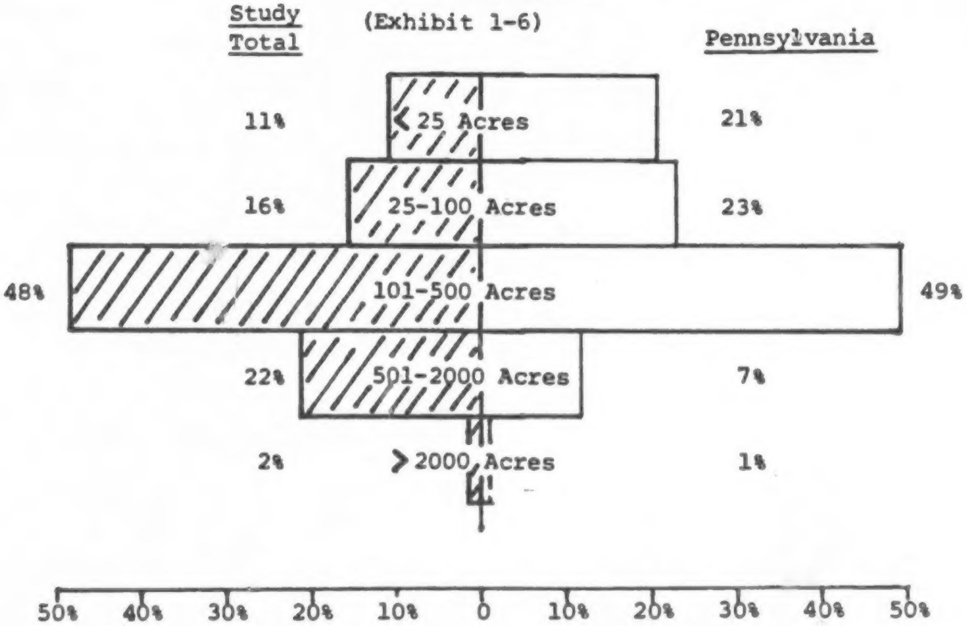
PRINCIPAL PESTS

(Exhibit 1-5)



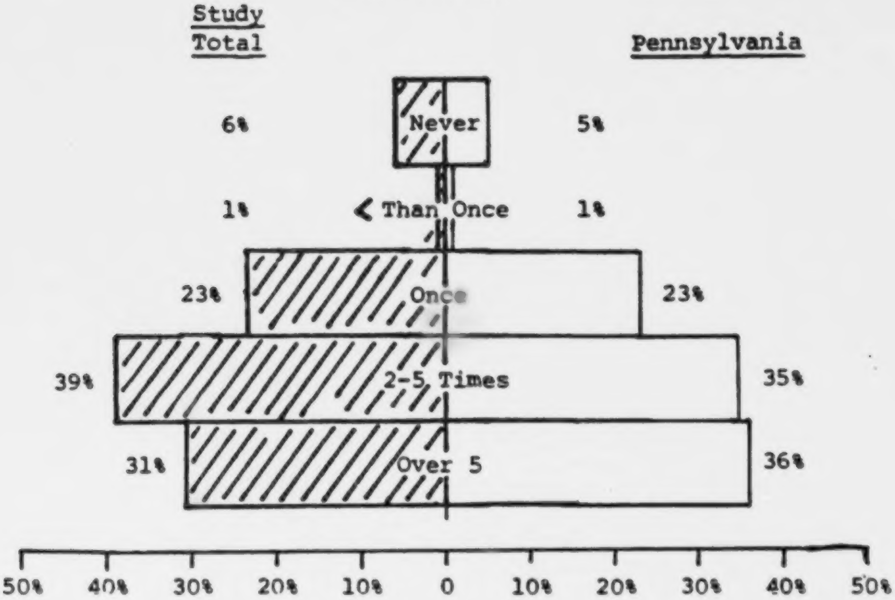
ACRES FARMED

(Exhibit 1-6)



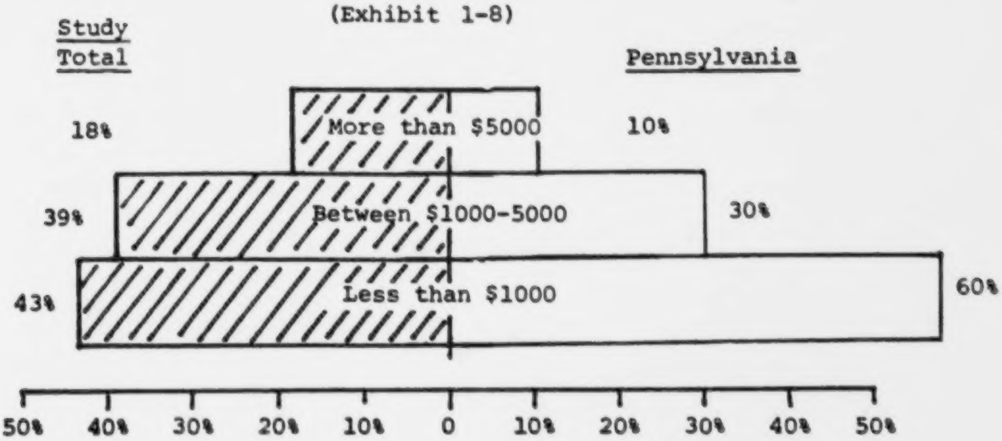
PESTICIDE APPLICATIONS PER YEAR

(Exhibit 1-7)



PESTICIDE EXPENDITURES LAST YEAR

(Exhibit 1-8)



2.0 ANALYSIS OF TRAINING PROGRAM CHARACTERISTICS

2.1 Program Description and Overall Assessment

Pennsylvania is somewhat unique in its training and certification procedures. The program was designed for self-study using a correspondence course manual, with training sessions offered at the discretion of the county agent. This manual is delivered with a self-administered examination, a standardized answer sheet, and a return mail envelope for the answer sheet. The examination is designed to be completed with the aide of the training manual and serves as the certification examination.

Instead of the self-study approach, the applicant may opt to attend training sessions, but only if the county agent elects to hold a training session. The training session essentially reviews the materials contained in the training manual. In the first few years of operation of the training and certification program in Pennsylvania, many of the county agents did elect to hold training sessions, but since mid-1979, fewer and fewer training sessions have been held. In the first few months of 1980, it is estimated that fewer than 10 percent of the applicants for certification attended training sessions.

In those training sessions which were or will be held, there is considerable variety of formats. Options include short question and answer sessions with a county agent, (usually no longer than an hour), or more formal presentations of the training manual materials by a county agent, a Pennsylvania State University Extension Specialist, a faculty member from a vocational agricultural school, an agricultural industry representative, or a combination of the above. The county agent chooses the format which would best suit the needs of the applicants in that county.

The training materials are obtained by mailing or telephoning a request to the College of Agriculture, Correspondence Course Office at the Pennsylvania State University, (along with a $6.00 fee for the training materials).

The initial private pesticide applicator certification is valid for only three years. To become recertified, an applicator must attend a update training session while his/her certification is still valid. These update training sessions are held throughout the year by the Cooperative Extension Service in conjunction with the Pennsylvania Department of Agriculture and representatives from agricultural industries. In these sessions, current topics in pest management are presented to the applicants, including topics such as resistant crop varieties, new products for pest management, and new application techniques. The update training sessions are designed not to review the topics covered in the training manual, but to permit the applicants to keep their knowledge of pest management current.

Like many other states, two organizations in Pennsylvania are responsible for coordination of the pesticide applicator training and certification program. The first is the Cooperative Extension Service, administered through the Pennsylvania State University. This organization coordinates the activities of the county agents in 67 counties and oversees the distribution of the training materials. The Pennsylvania Department of Agriculture is the other key agency in the program. While the role of the Cooperative Extension Service is one of education, the role of the Department of Agriculture is one of examination and certification. Certification is accomplished through successful completion of an examination. The Department of Agriculture maintains records on all certified applicators in the state.

The most distinctive feature of the Pennsylvania program is the availability of a self-study "correspondence course" option as a method of training and certification. Over half (57%) of all respondents in Pennsylvania took advantage of this option. The remainder were trained via group sessions (43%). This comparatively large percentage of respondents reporting the self-study option was far higher than any other state in our survey.

In terms of the source of pesticide assistance (see Exhibit 2-1), over half (55%) of the respondents in Pennsylvania report that they would turn first to their county agent if they were unsure about how to use a pesticide or which pesticide to use. This stands in contrast with states like Iowa and Nebraska where the chemical dealer is the primary source of assistance. The difference between Pennsylvania and these western states may be due, in part, to the strength of the chemical dealer network in the western states where it is much better developed than in eastern states like Pennsylvania. Another possible contributing factor is the high percentage of small farmers in Pennsylvania and the diversity of crops. It is possible that this type of grower might seek advice from the county agent not only because of his availability, but also because his knowledge of pesticides is more broadly based than that of a chemical dealer who might specialize in the pesticides of only a few manufacturers.

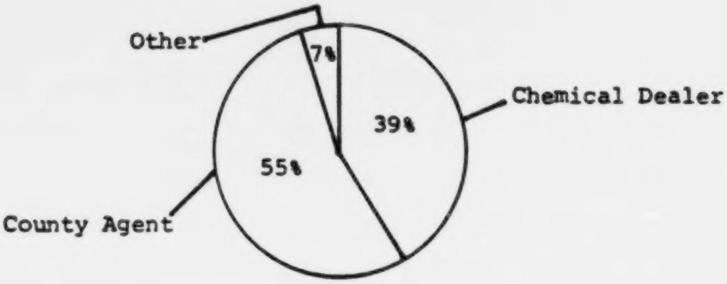
Exhibit 2-2 shows the perceived value of training, as reported by the respondents in Pennsylvania. Almost half (46%) considered the training to be very worthwhile, and only 9% reported that the training was not very worthwhile. This is almost the same as precentage distribution for the study sample as a whole.

2.2 Advantages and Disadvantages of the Program

Exhibit 2-3 shows the responses (therefore, categories will not add to 100% due to multiple responses by any single respondent), by Pennsylvania applicators, to the question: what were the advantages of the certification training program? Almost three-quarters (74%) of the Pennsylvania respondents felt that the program teaches proper use, how to prevent misuse, and that the program limits use of pesticides to qualified people only. More than half (59%) said that the program creates awareness of the dangers of pesticides and the need for safety precautions. Only 12% said that the program helps to protect crops, livestock, wildlife and the environment. These percentages are almost exactly the same as those from the study sample as a whole.

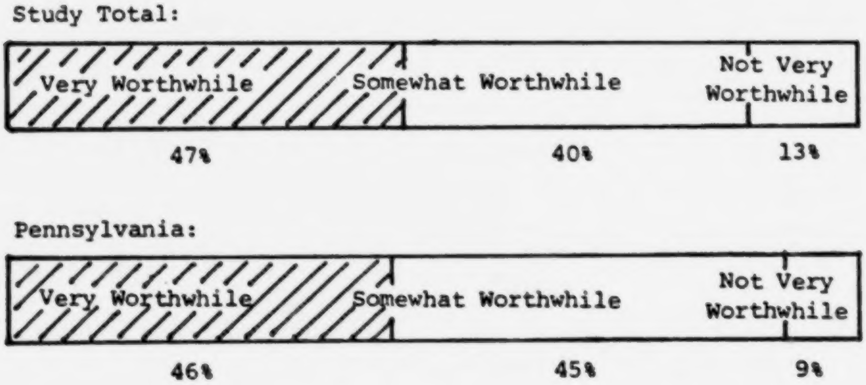
SOURCE OF PESTICIDE ASSISTANCE

(Exhibit 2-1)



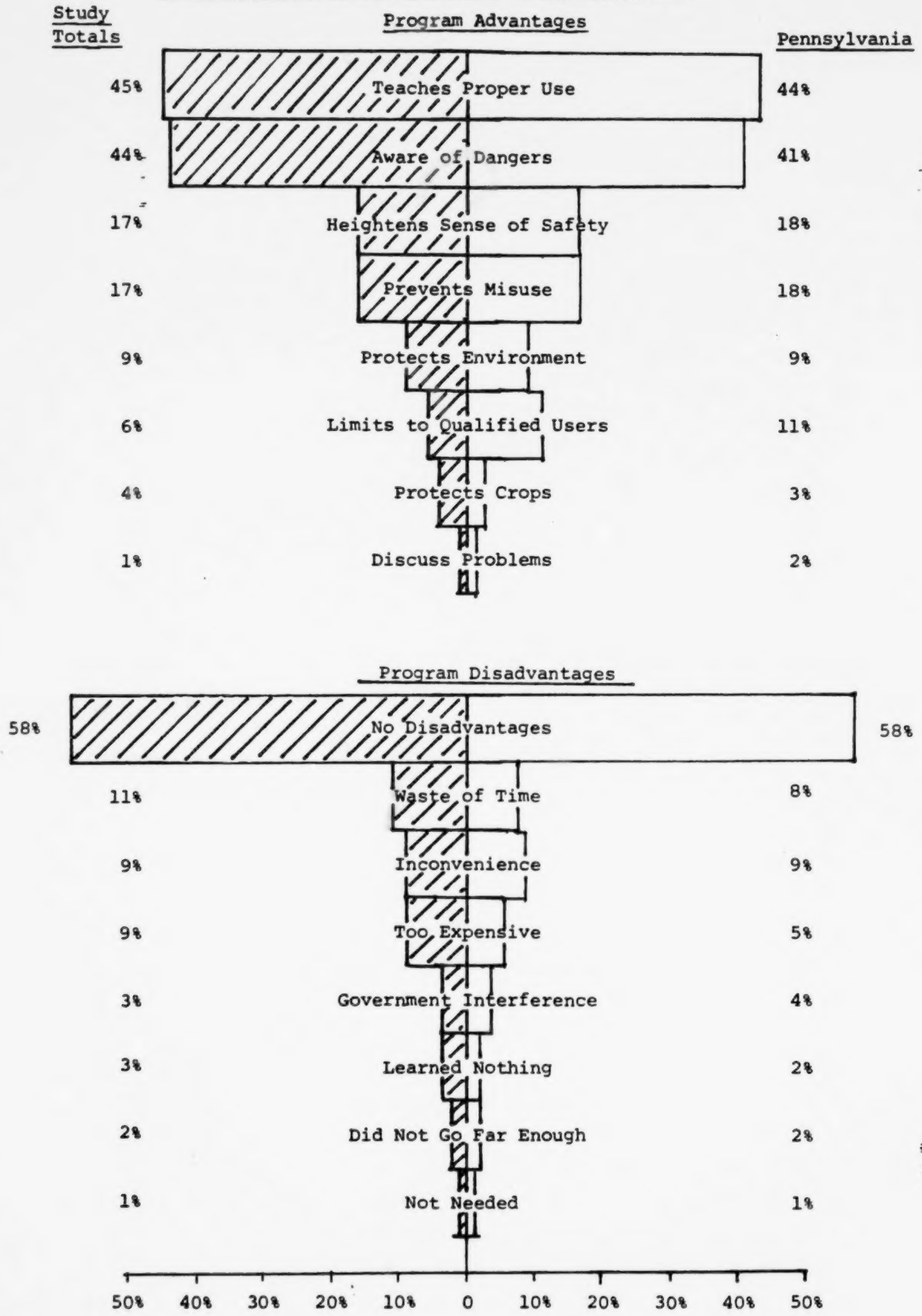
PERCEIVED WORTH OF TRAINING

(Exhibit 2-2)



(Exhibit 2-3)

ADVANTAGES AND DISADVANTAGES OF THE STATE PRIVATE APPLICATOR TRAINING AND CERTIFICATION PROGRAM



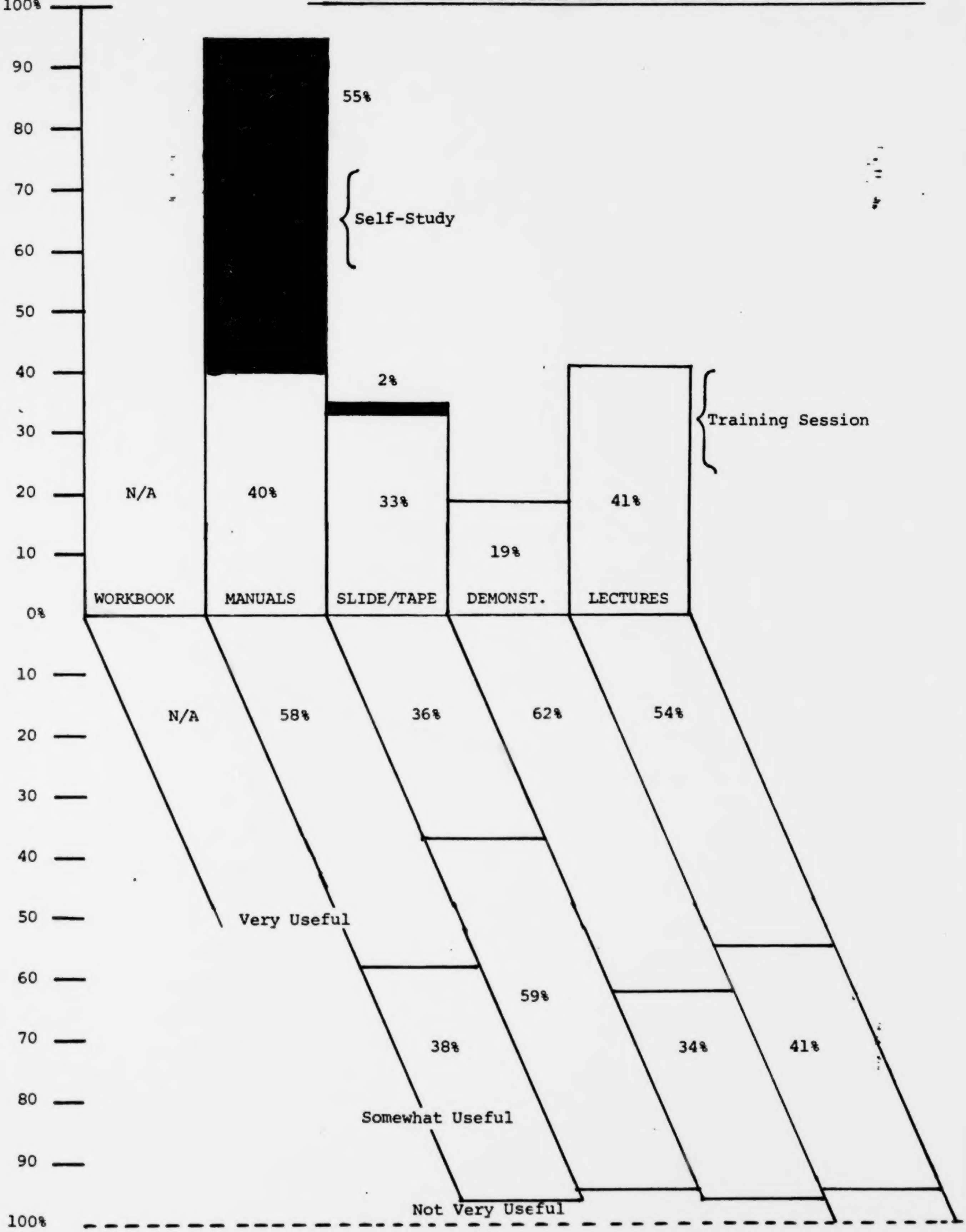
In terms of disadvantages perceived by the Pennsylvania respondents, 58% perceived no disadvantages; 17% said that the program was an inconvenience, unimportant, and a waste of time; 8% said that the program was too expensive and involved too much government interference; and 5% said that the program was too simple, irrelevant to the job, or that it didn't teach anything new. These responses are summarized in Exhibit 2-3. Again, the percentages from the Pennsylvania respondents were almost exactly the same as those from the study sample as a whole.

2.3 Assessment of Individual Training Elements

Exhibit 2-4 shows the percentages of Pennsylvania respondents who received each of four different types of training elements (a slide-tape series, a demonstration, lecture and the training manual) and their assessment of the usefulness of each training element. The most common type of training element was the training manual--available to all self-study and training session respondents--and its perceived usefulness was second only to the demonstration. The demonstration, in contrast, was available only to 19% of the respondents (i.e., it was available to some, but not all, of the training sessions, at the option of the county agent), but its perceived usefulness was the highest. The slide/tape series was available to over one-third of all respondents (again, to training session respondents only, at the option of the county agent), and its perceived usefulness was the lowest of all. Only 36% of the respondents who had seen the slide/tape series said that it was "very useful." The lecture was available to even more respondents (41%), and its perceived usefulness was substantially higher than the slide/tape series. Over half (54%) of those respondents who had lectures as part of the training session said that the lecture was "very useful."

A central feature of the Pennsylvania program is the large percentage of respondents who were trained by the self-study method. For those respondents, the only possible training element is the training manual. Yet, if one judges the training elements on the basis of their perceived usefulness, it appears that the self-study respondents may not have missed very much. The training manual, available to self-study and

ASSESSMENT OF INDIVIDUAL TRAINING ELEMENTS (Exhibit 2-4)



training session respondents, is clearly one of the elements perceived as most useful by the respondents. The self-study respondents did not see the slide/tape series or hear the lecture, but these were judged to be less useful than the training manual. The only aspect of the training available to training session respondents only which seems to have been perceived as more useful than the training manual was the demonstration, available only to some of the training session respondents. One must remember that the training session was designed at the discretion of the county agent. The only mandatory training element was the lecture. The other optional training elements--slide/tape series and demonstration--were offered only when the country agent decided that they should be included.

2.4 Initial Certification and Assessment of Certification

When the worth of training is compared to the perceived importance of certification, almost half of the Pennsylvania respondents rated certification of pesticide applicators as "very important," as shown in Exhibit 2-5. Only 15% of the respondents in Pennsylvania reported that certification was "not very important." These figures are almost identical to those from the full sample. Significantly more Pennsylvania respondents felt that certification was not very important than did those who rated the value of training as not very worthwhile. In all states in the study, those who were recertified tended to perceive the value of training as higher than the perceived value of recertification.

The Pennsylvania pesticide applicator training program began on a pilot basis in 1975 and became operational in 1977. This history of the program is reflected in the data on year of initial certification for the respondents in our sample, shown in Exhibit 2-6. Almost 70% of the respondents were reported being certified in 1977 or 1978.

The reported year of certification expiration for the Pennsylvania respondents is also shown in Exhibit 2-6. The data show that more than 70% of all respondents report that their certification expired in 1980. The data reflect some confusion on the respondents' part regarding when their initial certification actually expires.

PERCEIVED IMPORTANCE OF CERTIFICATION AND OVERALL WORTH OF TRAINING (Exhibit 2-5)

IMPORTANCE OF CERTIFICATION

Very Important	Somewhat Important	Not Very Important
48%	37%	15%

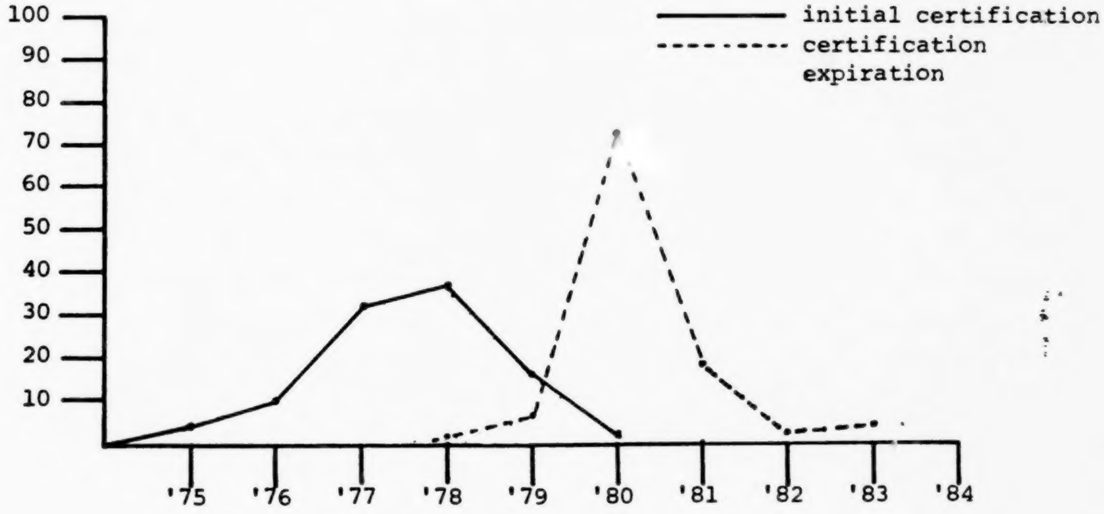
OVERALL WORTH OF TRAINING

Very Worthwhile	Somewhat Worthwhile	Not Very Worthwhile
46%	45%	9%

(Exhibit 2-6)

*YEAR OF INITIAL CERTIFICATION	*YEAR OF CERTIFICATION EXPIRATION
1975: 4%	1978: 1%
1976: 10%	1979: 6%
1977: 32%	1980: 71%
1978: 37%	1981: 18%
1979: 15%	1982: 2%
1980: 2%	1983: 3%

*Data shown is as reported by respondents. In fact, the Pennsylvania training and certification program was officially started in 1977. The data reflects an obvious confusion by respondents as to when they were initially certified and when their certification actually expires.



2.5 Recertification Status and Assessment of Recertification

As indicated by the previous section, Pennsylvania was among the earliest states in our sample in terms of the startup of its certification program. It has maintained that position also in terms of the startup of recertification. As shown in Exhibit 2-7, over half of all respondents from Pennsylvania reported being already recertified. In contrast, a neighboring northeastern state, New York, does not plan to begin recertification until 1984.

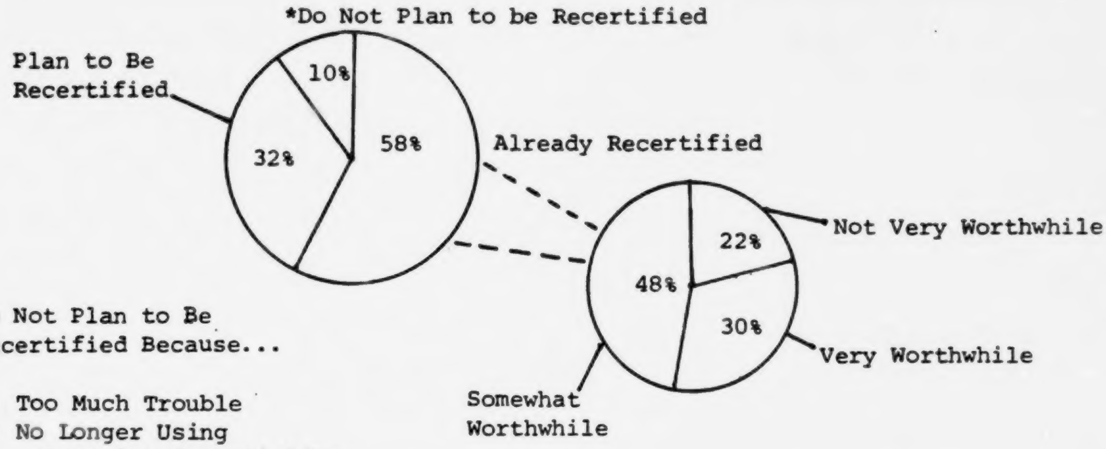
Ten percent of the Pennsylvania respondents reported that they do not plan to be recertified. This was higher than all other states except Iowa, where 19% reported that they were not planning to be recertified, but it was only slightly higher than the percentage for the study sample as a whole (9%). No single reason accounted for the number of respondents who did not plan to be recertified. The three leading reasons were: no longer using restricted pesticides, no longer farming, and too much trouble.

Of those respondents who reported that they were already recertified, 22% said that the recertification was "not worthwhile." Thirty percent said that the recertification was "very worthwhile," and the remainder found recertification to be "somewhat worthwhile," as shown in Exhibit 2-7. These percentages are almost identical to those of the study sample as a whole.

2.6 Training Assessment by Background Characteristics

As we reported in Section 2.1, almost half of all respondents in Pennsylvania said that the training program was "very worthwhile," and only 9% said that it was "not very worthwhile." One might assume that these opinions would vary by respondent on the basis of respondents' background characteristics such as number of acres farmed, age, education, etc. For example, if the number of acres farmed was very small, indicating that the applicator was only a part-time farmer, or indicating that farming was only a secondary occupation, then the respondent might have considered the training to be not as important as would a respondent for whom farming was a full-time primary occupation.

RECERTIFICATION PLANS (Exhibit 2-7)



*Do Not Plan to Be Recertified Because...

1) Too Much Trouble
2) No Longer Using Restricted Pesticides
3) No Longer Farming
4) Not Necessary - No Reason Given

VALUE OF RECERTIFICATION

These assumptions, however, were not supported by the data. There were no statistically significant correlations between perceptions of training worth and any of the following background characteristics:

- number of acres farmed;
- last year of school completed;
- age;
- years of experience using pesticides; and
- pesticide applications per year.

There was, however, a slight negative correlation (r=-.07) between perceived training worth and the amount spent on pesticides last year, as shown below. Apparently, those who spend less on pesticides report that the training is more worthwhile than those who spend more on pesticides.

Correlation Between Training Worth and Background Characteristics

	Pennsylvania	Study Total
Number of acres farmed	a	-.14
Last year of school completed	a	-.05
Age	a	.08
Years of pesticide experience	a	-.03
Spent on pesticides last year	-.07	-.13
Training or self-study	a	a
Pesticide applications per year	a	

[a] Indicates that the correlation is not significant at the .05 level.

3.0 ANALYSIS OF BEHAVIORAL CHARACTERISTICS

3.1 Reported Behavioral Impacts

Respondents were asked to report on any changes in their behavior with respect to the use of pesticides after the training. These questions were directed specifically at eleven different types of areas where behavioral changes were expected to occur. (A list of the number of reported behavioral areas impacted, along with a summary of the responses from Pennsylvania and the whole study sample, are shown in Exhibit 3-1. In general, the respondents in Pennsylvania followed the same pattern as the whole study sample, e.g., more respondents reported changing their behavior with respect to mixing and loading pesticides than for any other type of behavioral change. Exhibit 3-2 shows specific impact areas in which the respondents indicated that there had been some behavioral changes subsequent to training. The data for Pennsylvania respondents and the full study sample are both presented in the same tabular format. This shows that the Pennsylvania respondents reported behavioral changes in slightly more impact areas than the study sample as a whole. Almost four-fifths (78%) of the Pennsylvania growers reported behavioral change in at least one of the impact areas, and 40% reported changes in at least four impact areas. In the following sections, we will discuss each of the eleven behavioral impact areas and the responses from Pennsylvania.

3.1.1 Pest Identification and Crop Damage Allowed

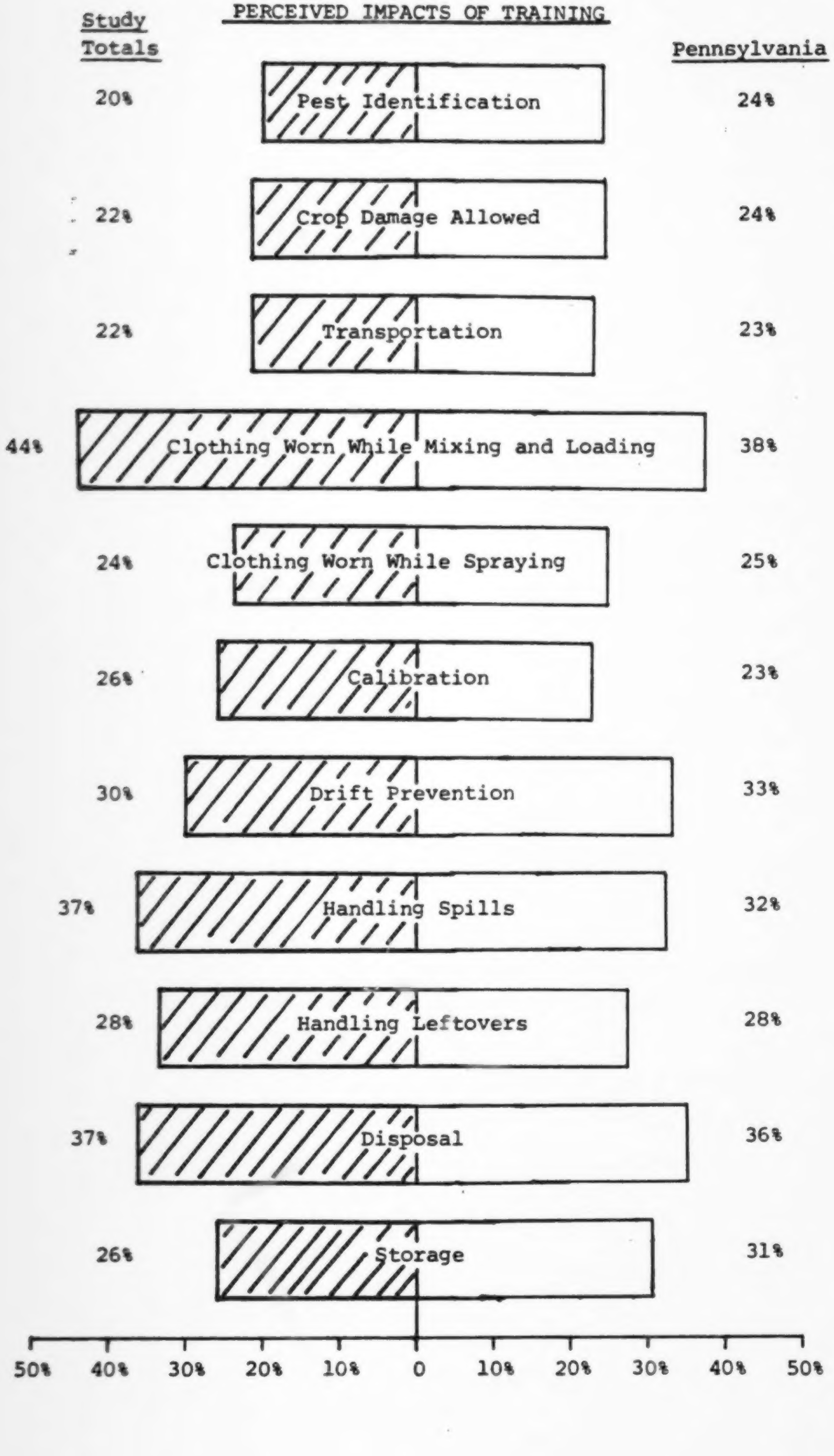
The ability to distinguish among the various pests that might be threatening to crops, coupled with an ability to make judicious decisions about how much crop damange to allow, are important skills for proper use of pesticides. About one-quarter of the respondents in Pennsylvania reported that their behavior in these two areas had changed subsequent to training. This was a slightly higher percentage than for the study sample as a whole (20% and 22%, respectively, for these two types of behavioral changes).

Exhibit 3-1

Number of Reported Behavioral Areas Impacted

Number of Behavioral Areas Impacted	Pennsylvania		Study Total	
	Relative Frequency	Cumulative Frequency	Relative Frequency	Cumulative Frequency
0	22%	22%	24%	24%
1	15	37	13	37
2	11	48	11	48
3	12	60	11	59
4	11	71	10	69
5	8	79	9	78
6	7	86	7	85
7	5	91	5	90
8	4	95	4	94
9	3	98	3	97
10	1	99	2	99
11	1	100	1	100

Exhibit 3-2
PERCEIVED IMPACTS OF TRAINING



3.1.2 Pesticide Transportation

Twenty-three percent of the Pennsylvania respondents said that they had changed their behavior in transportation of pesticides subsequent to the training. This was almost the same as that for the study sample as a whole (22%). Specific types of changes in transportation included: being more careful, keeping the pesticide in a truck bed or trunk of a vehicle, and keeping the pesticide in a closed container.

3.1.3 Protective Clothing

Clothing worn while mixing and loading was the area where the greatest percentage of Pennsylvania respondents (38%) reported changes in their behavior. It was also the area where the largest number of respondents in the study sample as a whole (44%) reported changing their behavior. Almost one-third (29%) of the Pennsylvania respondents reported that they now use waterproof gloves while mixing and loading. (This is a larger percentage of the Pennsylvania respondents than reported changes in several of the other behavioral areas.) Other notable changes in types of clothing worn while mixing and loading include: 14% of the Pennsylvania respondents said that they wear a respirator or filter mask, and 12% said that they wear goggles or glasses.

It is significant to note that Pennsylvania had the lowest percentage of respondents reporting any change in clothing worn while mixing and loading. This stands in sharp contrast to other behavioral areas, where Pennsylvania respondents usually reported being about at the average for the study sample as a whole.

A substantially smaller percentage of Pennsylvania respondents reported that they had made changes in the clothing worn while spraying, however. Only 25% of the respondents mentioned changes in this area, compared with 38% who said they had changed their behavior with respect to clothing worn while mixing and loading. Also, whereas the Pennsylvania respondents had the lowest percentage of changes in clothing worn while mixing and loading--compared to other states, the Pennsylvania responses for the area of clothing worn while spraying were almost exactly the same as that for all respondents in the study sample, as shown in the graphic summary in Exhibit 3-2.

3.1.4 Equipment Calibration

Twenty-three percent of the respondents in Pennsylvania reported that they had made changes in their behavior with respect to equipment calibration subsequent to training. Possible changes in behavior included: calibrating more carefully, calibrating more often, measuring more carefully, and following instructions more closely. None of these specific changes in behavior was the dominant response. In comparison with the study sample as a whole, the Pennsylvania respondents reported slightly fewer changes in ths impact area, as shown in Exhibit 3-2.

3.1.5 Drift Prevention

Changes in methods of spraying to prevent drifting was one of the impact areas where the most changes were noted in Pennsylvania. One-third of the Pennsylvania respondents reported changes here, compared with 30% of the study sample as a whole. Compared with the other states, Pennsylvania had the second-highest number of reports of changes in behavior in this area. The dominant change in behavior was to spray only when the wind is low. Twenty-four percent of the Pennsylvania respondents mentioned this specific change in behavior.

3.1.6 Handling Spills and Leftovers

In these two behavioral impact areas--handling pesticide spills and handling leftover pesticide--the Pennsylvania respondents reported fewer changes than did the study sample as a whole. For example, only 32% of Pennsylvania respondents reported differences since training in handling spills, while 37% of the full study sample reported differences since training. In comparison with the other states, Pennsylvania ranked last in this area, reporting the fewest changes in behavior. In the area of handling leftover pesticide, Pennsylvania was next to last, surpassing only Iowa in the percentage of respondents reporting any differences since training. Twenty-eight percent of the Pennsylvania respondents had made changes in their methods of handling leftovers; and while this was one of the lowest responses of the five states, it was exactly the same as the study sample as a whole because of the slight variation among states.

3.1.7 Pesticide Storage and Disposal

Pennsylvania ranked first among the five states in terms of the number of respondents reporting changes in the behavioral impact area of differences in methods of pesticide and equipment storage. Thirty-one percent of the Pennsylvania respondents reported changes in this behavioral impact area, compared with 26% of the study sample as a whole, as shown in Exhibit 3-2. The dominant types of specific changes in behavior noted in Pennsylvania were: keeping pesticides locked, keeping pesticides in a special shed, and keeping pesticides away from children and/or animals. In a related area--disposal of pesticides--Pennsylvania was almost identical to the average for the study sample as a whole. Thirty-six percent of Pennsylvania respondents noted changes in the methods of pesticide container disposal, compared with 37% of the study sample as a whole, as shown in Exhibit 3-2. There were two dominant types of behavioral changes since training in the container disposal area: burning the containers and burying the containers. Sixteen percent of the Pennsylvania respondents said that they now bury pesticide containers, but did not do so prior to the training.

3.2 Reported Behavioral Impacts by Background Characteristics

A summary of the relationship between background characteristics and the number of behavioral impact areas where changes were reported is shown in Exhibit 3-3. It shows, for example, that the correlation coefficient on the relationship between age and number of behavioral impact areas where changes were reported is -.11, i.e., that as age increases, the number of impact areas where changes were reported decreases. Other statistically significant relationships are: a positive correlation (r=.17) between education and number of impact areas where changes were reported, and a positive correlation (r=.22) between the number of pesticide applications per year and the number of impact areas where changes were reported.

Exhibit 3-3

Number of Behavioral Impact Areas with Reported Changes by Background Characteristics

	Pennsylvania	Total Sample
Age	-.11	a
Education	.17	.06
Farm Size	a	a
Years of Pesticide Experience	a	-.06
Frequency of Pesticide Application	.22	.23
Pesticide Expenditures, 1980	a	a

[a] Indicates correlations are not statistically significant at the .05 level.

Interpretation of these correlations is rather straightforward. The younger and better educated growers made changes in more areas than did the older and less educated growers. In other words, the training resulted in changes in more types of behavior for those growers who were younger and/or better educated. Also, the training resulted in a broader range of changes in behavior for those growers who applied pesticides frequently and who, because of this more frequent exposure to pesticides, were more likely to take greater care to reduce risks to health and safety. None of the other background characteristics--years of experience with pesticides, acres farmed, or pesticide expenditures--showed any statistically signficiant correlation with number of impact areas.

Pennsylvania showed statistically significant correlations between background characteristics and number of behavioral impact areas for more of the background characteristics than any other state, suggesting that the effect of training is mediated more strongly by background characteristics in Pennsylvania than elsewhere--possibly due to the unique "correspondence course" method by which most private applicators in Pennsylvania are trained. In terms of the sign of the correlations (positive or negative), the results from Pennsylvania were consistent with the results from the full study sample.

Exhibit 3-4 shows the correlation between background characteristics and behavioral changes since training, by behavioral impact area. The most striking results are: (1) there is a strong effect of all background characteristics on changes in behavior in the pest identification impact area; and (2) of all the background characteristics, only two--education and age--have broad effects across several different impact areas. Each of these results will be discussed in the paragraphs below.

The relationship between background characteristics and pest identification is statistically significant across all six background characteristics. In general, changes in the pest identification area since training are correlated with small farm size, more education, youth, fewer years of experience with pesticides, more pesticide usage each year, and fewer pesticide expenditures. The farm size and pesticide expenditure variables are correlated with each other, and the data

Exhibit 3-4

Reported Behavioral Impacts by Background Characteristics

	Pest Identification	Crop Damage Allowed	Transportation	Clothing While Mixing	Clothing While Spraying	Equipment Calibration	Drift Prevention	Handling Spills	Handling Leftovers	Pesticide Disposal	Pesticide Storage
Farm Size	-.12	a	a	a	a	a	a	a	a	a	-.09
Education	.24	.12	a	.13	.14	a	.18	.11	a	a	.10
Age	-.11	-.14	-.13	a	a	-.13	a	a	a	.11	a
Years of Experience with Pesticides	-.17	a	-.12	a	a	a	-.09	a	a	a	a
Pesticide Usage per Year	.12	a	a	a	a	a	a	a	a	a	.13
Pesticide Expenditures Last Year	-.10	.10	a	a	a	a	a	a	a	a	a

[a] Indicates correlations not statistically significant at the .05 level.

suggest that the smaller growers are more likely to report changes in pest identification behavior. The relationships between education, age, and pesticide usage per year with changes in pest identification since training are similar to the effect of these background characteristics on all of the other issue areas, as reported in the previous paragraphs. The effect of years of experience with pesticides (which has a negative correlation with changes in behavior) suggests that the more experienced growers are less likely to report any changes in their pest identification behavior. This negative correlation--like all negative correlations reported in this section--is open to at least two different interpretations. On the one hand, one might assume that the growers with more experience in pesticide usage already know a lot about pest identification, and that therefore, they are less likely to change their behavior after training. On the other hand, one might interpret this result as suggesting that the more experienced growers are set in their ways and unlikely to change their behavior, regardless of how much they know about pest identification prior to training.

The relationship between education and behavioral change is positive and statistically signficiant in seven of the eleven impact areas. This shows that the better-educated growers were more likely to report a change in their behavior after training than the less-educated growers. The fact that this association appears consistently and fairly strongly ($r>.20$) in Pennsylvania but in none of the other study states, suggests that the self-study approach to training may benefit more educated growers somewhat more than it benefits the less educated growers.

The relationship between age and behavioral change is negative in four of the impact areas and positive in one of the impact areas. Negative correlations exist between age and pest identification, crop damage allowed, transportation, and calibration. A positive correlation exists between age and pesticide disposal. The negative correlations show that the younger respondents were more likely to report behavioral change, except in the area of pesticide disposal, where the older respondents were more likely to report behavioral change.

Exhibit 3-4 contains a complete summary of all of the relationships between background characteristics and reported changes in each of the eleven behavioral impact areas. In general, the strongest relationships are between fundamental demographic characteristics of our sample--e.g., education and age. Other relationships, although statistically significant in one or two impact reas, are not strong and significant across the broad spectrum of impact areas. Also, as mentioned above, the respondents in Pennsylvania exhibited a stronger linkage between background characteristics and number of impact areas where change was reported than any other state. This may reflect the diversity of the population of growers who use pesticides in Pennsylvania.

3.3 Reported Behavioral Impacts by Training Characteristics

Exhibit 3-5 shows the correlation between several training characteristics and the number of impact areas where respondents in Pennsylvania reported a change in behavior subsequent to training. The Pennsylvania responses, like those for the study sample as a whole, show a statistically significant correlation with only two of the training characteristics: source of information about pesticides, and assessment of training worth. The strongest relationship is that with the assessment of training worth, showing that those respondents who gave a more positive assessment of the training program were more likely to report behavioral changes in a large number of impact areas since training. One way of interpreting this correlation is to say that those growers who changed their behavior because of the training were also more likely to favorably evaluate the training program. The positive correlation with source of information about pesticides means that there were reports of changed behavior in one or more impact areas if the source of information was the county agent, rather than the chemical dealer.

Of particular interest for this evaluation of Pennsylvania is the fact that the type of training (self-study vs. training session) is not correlated with the number of impact areas where changes are reported after training. As we shall see in Section 4.0, the type of training seems to have little if any effect on behavior change after training.

Exhibit 3-5

Number of Behavioral Impact Areas with Reported Changes by Training Characteristics

	Pennsylvania	Total Sample
Year of Initial Certification	a	a
Training Type	a	a
Source of Pesticide Assistance	.15	.16
Assessment of Training Worth	.25	.33

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[a] Indicates correlations are not statistically significant at the .05 level.

Exhibit 3-6 shows the correlation between three of the training characteristics and reported changes in behavior across all of the eleven impact areas. Only one of the training characteristics shows a statistically significant correlation: the assessment of training worth. Where the assessment of training worth is high, there are reported changes in behavior, across all eleven impact areas. Interpretation of this result, as well as the absence of a statistically significant correlation between training type and behavioral change, is similar to that reported in the paragraphs above when discussing the correlation between training characteristics and the number of impact areas where changes were reported.

In summary, the relationship between training characteristics is generally straightforward in Pennsylvania and consistent with the pattern shown in the full study sample.

3.4 Reported Behavioral Practices of Nonimpacted Respondents

For eight of the impact areas we asked the respondents who reported no changes in behavior since training to identify the practices that they follow in dealing with pesticides. The responses to these questions for Pennsylvania are reported in Exhibit 3-7. In general, the behavioral practices of thee nonimpacted Pennsylvania growers were rather similar to those of the nonimpacted respondents for the total study sample.

The differing response percentages between Pennsylvania and the total sample--pertaining to methods of pesticide transportation--merely reflect the growers' more common usage of cars as well as trucks compared to any of the other states. All but 5% of those asked reported acceptable transporting practices in Pennsylvania. In the area of protective gear worn while working with toxic pesticides, the nonimpacted respondents in Pennsylvania show the same tendency as the five states combined to wear their masks, goggles, and gloves while mixing and loading but not while spraying such pesticides. The use of goggles is not as prevalant in Pennsylvania as in the Midwest (20% reported usage while mixing and loading pesticides compared with 42% in the two Midwestern states surveyed), but the opposite is true in the case of respirators (23% reported usage in Pennsylvania compared to 8% in the Midwest), and raincoats (15% in Pennsylvania compared to 2% in the Midwest).

Exhibit 3-6

Reported Behavioral Impacts by Training Characteristics

	Pest Identification	Crop Camage Allowed	Transportation	Clothing While Mixing	Clothing While Spraying	Equipment Calibration	Drift Prevention	Handling Spills	Handling Leftovers	Pesticide Disposal	Pesticide Storage
Year of Initial Certification	a	a	a	a	a	a	a	a	a	a	a
Training Type	a	a	a	a	a	a	a	a	a	a	a
Source of Pesticide Assistance	.16	a	a	.10	.16	a	.17	.14	.14	a	.20
Assessment of Training Worth	.16	.10	.17	.23	.16	.07	.13	.26	.21	.20	.17

[a] Indicates correlations not statistically significant at the .05 level.

Exhibit 3-7

Reported Behavioral Practices of Nonimpacted Respondents

	Pennsylvania (%)	Total (%)
1. Methods of Pesticide Transportation		
Bed of Truck	79	84
Trunk of Car	11	4
Truck cab/car seat	5	4
Other method (e.g., closed container)	5	2
2. Clothing Worn When Mixing and Loading		
Waterproof gloves	61	64
Waterproof boots	15	12
Long-sleeved shirt	25	25
Long trousers	18	16
Goggles or glasses	20	29
Respirator or filter mask	23	17
Dust mask	19	22
Hat	20	15
Coveralls	26	22
Raincoat or rainsuit	15	10
Other clothing	5	4
None worn/necessary	11	12
3. Clothing Worn While Spraying		
Waterproof gloves	41	40
Waterproof boots	15	12
Long-sleeved shirt	28	27
Long trousers	21	19
Goggles or glasses	14	20
Respirator or filter mask	21	15
Dust mask	17	15
Hat	25	21
Coveralls	27	23
Raincoat or rainsuit	13	11
Other clothing	5	4
None worn/necessary	15	21
4. Frequency of Calibration		
Before each application	41	46
Before every other application	7	8
Before every 3 or 4 applications	16	13
Less often	30	22
Other (once a year)	6	6

Exhibit 3-7 (continued)

Reported Behavioral Practices of Nonimpacted Respondents

	Pennsylvania (%)	Total (%)
5. Methods of Drift Prevention		
Spray when wind is low	84	80
Spray with wind direction	7	13
Spray during cooler times	4	4
Use lower pressure	7	10
Use larger nozzle opening	5	6
Use drift control agent	0	2
Spray closer to ground	12	11
Other method (e.g., not when raining)	14	18
No precaution taken/necessary	4	4
6. Methods of Handling Leftovers		
Drain it or bury it in ground	6	12
Leave it in applicator	5	4
Apply it to another field	6	5
Continue spraying until applicator empty	18	18
Dilute, then spray until applicator empty	2	2
Store in closed container	44	39
Don't have any leftover	22	18
Other methods (e.g., take to dealer)	9	12
7. Methods of Pesticide Disposal		
Burn them	41	37
Bury them	35	34
Rinse them	14	18
Crush or puncture them	5	14
Haul them to a landfill	11	22
Take them to a dump	19	15
Store them in a special place awaiting disposal	5	3
Other methods (e.g., take to dealer; re-use them)	10	8
8. Methods of Pesticide and Equipment Storage		
Keep them locked	18	14
Keep them in special area/shed/building	78	77
Keep them away from children/animals	9	10
Wash/clean before storing	20	24
Store away from extreme heat	9	7
Other methods (e.g., take to dealer)	4	8

Nearly one-third of those asked in Pennsylvania reported calibrating their application equipment less than every 3 or 4 applications compared to 22% of the total sample, reflective no doubt of the smaller farm sizes and higher frequency of application in Pennsylvania than in the other states. By far the most common method of preventing spray drift employed by the growers in Pennsylvania and elsewhere is to spray when the wind is low, mentioned by over 80% of those asked.

The percentage of nonimpacted Pennsylvania growers who report rinsing (14%), crushing or puncturing (5%), and hauling to a community landfill (11%) their empty pesticide containers are all below the corresponding Midwest percentages. Some emphasis on these activities during recertification seems desirable. Finally, in the area of pesticide and equipment storage, the percentage of Pennsylvania private applicators who reported locking their pesticides and equipment (18%) was twice the corresponding Midwest average (9%). Nevertheless, since less than one grower in five mentioned locking his pesticide, in any study state, this activity should probably be reemphasized in the recertification programs of all five states.

4.0 COMPARISON OF SELF-STUDY AND TRAINING SESSIONS IN PENNSYLVANIA

The respondents in Pennsylvania are almost evenly divided between two approaches to training. Over half of all respondents (57%) were trained by a self-study manual that is unique to Pennsylvania. The large number of self-study respondents permits a comparison of the two approaches to training. Highlights of this comparison are the following: (1) the self-study respondents were slightly different from the training session respondents in terms of their demographic characteristics and experience with pesticides, but none of these differences would appear to be related to training effectiveness; (2) the behavioral outcomes of training show no significant differences between the self-study respondents and training session respondents; and (3) the perceptions or training worth and certification importance also showed no significant differences between the self-study respondents and the training session respondents. In short, judged simply on the basis of effectiveness of training, there seem to be no significant differences between self-study and training sessions.

4.1 Background on Self-Study in Pennsylvania

The pesticide training and certification program in Pennsylvania was developed in late 1974. From its inception, the program was designed as a correspondence course, with training sessions offered at the discretion of the county agent. The training materials consist of a manual designed for self-study use. The manual includes a self-administered examination which also serves as the certification examination for those following the self-study approach. Since mid-1979, fewer and fewer training sessions have been held.

Reliance on the self-study method for training and certifying pesticide applicators is consistent with the traditional emphasis at Penn State University (where the training program was designed) on correspondence courses for growers. According to authorities from Pennsylvania, reliance on correspondence courses in the past made them confident that self-study would be a reasonable and effective alternative to training sessions.

It appears that the self-study method of training and certification also has advantages in terms of its cost-effectiveness. Although no data are available from the state officials responsible for the program, these officials say that the cost advantages are clear. The fixed cost of preparation of the training manuals is the same for both options, self-study and training session. All costs for shipping and handling of the manual are recovered in the $6.00 fee charged for the manual. The costs of grading the self-study certification examination are borne by the Pennsylvania Department of Agriculture, and they represent a small portion of the total cost of record-keeping for all applicators, regardless of the method of training. In contrast, there are substantial labor costs involved in the training session--e.g., the time of the county agent who administers the training, and the time of a specialist from Penn State who may attend and participate in the training session. Training sessions also may involve transportation costs since a Pennsylvania State University specialist must travel to the training session.

The self-study method also has certain advantages for growers who do not have the time available to go to training sessions. It permits them to study the materials at their own pace, in their own home. This is particularly useful in Pennsylvania for those small growers (who represent a substantial portion of the total grower population) for whom agriculture may be a secondary occupation.

4.2 Demographics: Comparison of Self-Study and Training Session

Exhibit 4-1 presents the demographic characteristics of both the self-study and training session respondent groups. These data show that the self-study respondents are slightly younger[1] and better educated than

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[1] The age of the respondents from the two groups is difficult to summarize neatly. The differences are not linear. For example, whereas there was a larger percentage of training session respondents than self-study respondents in the over-45 age group (52% compared with 46%), there also was a larger percentage of the self-study respondents than training session respondents in the over-55 age group. Our summary comment about the self-study group being "younger" refers only to the fact that a larger percentage of self-study respondents (54%) were less than 45 years of age compared with 48% of the training session respondents.

Exhibit 4-1

	Self-Study (N=231)	Training Session (N=177)
Size of Farm*		
<100 acres	49.3	36.0
101-500 acres	45.4	54.3
>500 acres	5.2	9.7
Education		
<HS Graduate	24.7	23.8
HS Graduate	40.3	47.2
>HS Graduate	35.1	29.0
Age**		
≤34	25.5	30.0
35-44	28.8	17.6
45-54	21.2	32.4
≥55	24.5	20.0
Pesticide Experience		
≤10 years	40.2	34.4
11-20 years	27.5	32.8
≥21 years	32.3	32.8
Pesticide Usage		
≤Once a year	28.8	30.2
2-5 times/year	34.5	34.1
≥6 times/year	36.7	35.8
Pesticide Expenditures*		
<$1000	65.7	52.0
$1000-$5000	26.1	35.3
>$5000	8.3	12.7

An asterisk means that the difference between the self-study and training session groups was statistically significant. (= prob < .05, ** = prob. < .01).

their training session counterparts. In terms of their experience with pesticides, the self-study respondents have slightly less experience; they are from smaller farms and have lower expenditures for pesticides. We emphasize the magnitude of these differences (by inserting the word "slightly") to remind the reader that in general these differences are not statistically significant. In fact, for many of the characteristics that might contribute to training outcomes--e.g., education--the two groups are virtually identical.

The most significant correlation (in a purely statistical sense) is between age and the choice of self-study vs. training session. This significance level, however, simply tells us that the distribution is not random. It also is not linear, thereby complicating our explanation of the relationship. The correlation coefficient is positive but small (r = .02), showing a slight preference by younger respondents for self-study. This may simply suggest that the older growers are less comfortable with the idea of self-study. For other age categories, however, the picture is not at all clear. For example, for the category 35 to 44, 29% chose self-study, and only 18% chose the training session. In the category 45 to 54, however, the picture is just the opposite: 32% chose the training session, compared with only 21% who chose self-study.

The other two variables where a statistically significant correlation appeared, however, are more straightforward in terms of interpretation. There was a negative correlation (r = -0.13) between size of farm and choice of self-study, and there was a negative correlation (r = -0.13) between amount spent on pesticides and choice of self-study. Since size of farm is a major determinant of the amount spent on pesticides, the similarity between these two background characteristics is clear. Our interpretation of these correlations is that the smaller farmers in Pennsylvania (e.g., the part-time farmers or persons for whom agriculture is a secondary occupation) are more likely to choose the self-study approach to training. According to officials from Pennsylvania, not only are the small growers less likely to have the time to go to a training session, but also the smaller growers may feel that their use of pesticides is so small that it does not warrant the investment to go to a training session. Larger growers, by contrast, may wish to go to a graining session so that they can learn about new pesticide developments from their county agents.

This result is significant for policy decisions regarding future developments in pesticide applicator training and certification. It suggests that the self-study method, which apparently has significant cost advantages over the training session, is as good as the training session in terms of behavioral change subsequent to training. It seems inappropriate to generalize from these findings from Pennsylvania to other states, but at least for Pennsylvania, the confidence in the correspondence course method--a confidence that led to the development of the self-study method in the first place--was well founded.

4.3 Behavioral Outcomes: Comparison of Self-Study and Training Session

The most important type of comparison between self-study respondents and training session respondents is in terms of the behavioral outcomes of training. Did the self-study group change their behavior in applying pesticides in ways that are different from those changes made by the training session group? The data, shown in Exhibit 4-2, show that there are no statistically significant differences between the two groups. There are, however, some significant differences in the relationship between education and reported impacts among self-study versus group session trainees. The fairly strong positive education effects discussed in Subsection 3.2, indicating that in Pennsylvania the more educated growers reported more benefits, appear in the self-study group but much less so in the training session group. For example, among the self-study trainees a correlation of .20 exists between education level and the number of reported behavioral impacts, compared to r = .12 for the group session trainees. While the difference between these two correlations is

Exhibit 4-2

	Self-Study (N=231)	Training Session (N=177)
Perceived Importance of Certification		
Very important	48.7	46.3
Somewhat important	37.4	37.1
Not very important	13.9	16.6
Perceived Worth of Training Overall		
Very worthwhile	47.0	44.0
Somewhat worthwhile	42.4	49.1
Not very worthwhile	10.0	6.9
Perceived Impacts of Training (% "yes")		
Pest identification	24.7	22.0
Crop damage allowed	24.2	21.5
Transportation	22.5	23.2
Mixing & loading	36.4	39.0
Application	23.4	26.6
Calibration	23.8	21.6
Drift Prevention	35.9	28.8
Handling Spills	30.3	33.9
Handling leftovers	27.7	27.1
Disposal	39.4	32.2
Storage	31.6	27.7
Recertification Plans		
Plan to be recertified	29.3	35.3
Do not plan to be	12.0	8.2
Already recertified	58.7	56.5
Perceived Worth of Recertification (for respondents already recertified)		
Very worthwhile	32.1	25.5
Somewhat worthwhile	45.0	53.2
Not very worthwhile	22.9	21.3

not statistically significant at the .05 level, significant differences do appear when individual behaviors are examined. In fact, for one behavior--methods of handling pesticide leftovers--a negative association ($r_1 = -.14$) exists between education and perceived impact for the training session group, whereas a positive education effect ($r_2 = .10$) exists for the self-study group ($Z_{(r_1 - r_2)} = 2.10$, $P < .05$). Also, for amount of crop damage allowed, protective clothing worn while spraying, and methods of handling pesticide spills, significant (positive) education effects appear only for the self-study trainees. These effects tend to confirm our hypothesis that the self-study approach in Pennsylvania, unlike the group session approach, benefits more educated growers somewhat more than the less educated growers.

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EVALUATION OF THE PRIVATE APPLICATOR PESTICIDE TRAINING AND CERTIFICATION PROGRAM: A FIVE-STATE STUDY

APPENDIX E: New York Evaluation Report

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APPENDIX E

NEW YORK EVALUATION REPORT

The Northeastern Core Manual, which is more detailed than the EPA Core Manual, was developed in the State of New York and provides the essential instruction for the private pesticide applicator training program. Unlike other states in the study, New York also supplements its training with a film on pesticide safety. The New York program is delivered in two sessions: the first session involves introduction to the Manual and viewing the film, and the second session involves a discussion of the Manual, viewing of the slide-tape series (based on the Manual), and the taking of a trial examination. This review is immediately followed by the 50-question state certification exam administered by a Department of Environmental Control Inspector. In all these respects, New York has the most rigorous training and certification procedures when compared to other states in the study.

Currently only 85% of the applicants attend training sessions; the remaining 15% are trained and certified via the self-study method. In either event, the certification exam must be taken and passed in order to receive certification. The certification exam is expected to be updated to require more knowledge in the safety areas of calibration, disposal and drift. It can be expected that these topics will also be emphasized when recertification begins in 1984. In lieu of a recertification process (which will require some form of retraining), New York growers whose original certification has "expired" have been required to renew their licenses each year. In reporting data on the recertification process, therefore, respondents were actually referring to the license renewal process. As is demonstrated in the subsequent sections of the Evaluation Report, the overall perceived value of the New York training and certification program was comparatively high and respondents reported significant changes in pesticide-related behaviors, and attitudes as a result of the private pesticide applicator training and certification program.

1.0 ANALYSIS OF BACKGROUND CHARACTERISTICS

In New York, 409 growers participated in the telephone survey of private pesticide applicators. Respondents were asked to provide the following demographic and agricultural information:

- age,
- educational background,
- experience with pesticides,
- principal crops,
- principal pests,
- farm size,
- frequency of pesticide use, and
- pesticide expenditures for 1980.

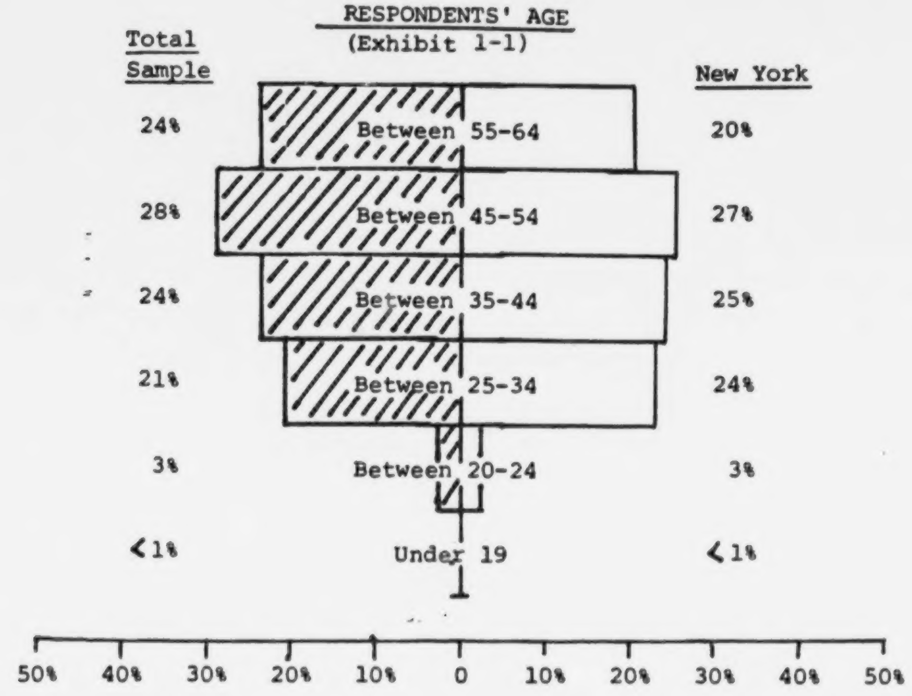
Each of these is discussed separately in the paragraphs which follow.

Age of respondent. New York's applicators were slightly younger than the five-state average, with 28% less than 34 years of age and only 20% aged 55 or older. As displayed in Exhibit 1-1, the entire five-state sample was very evenly distributed into the various age categories, with the exception of the "under 24 years" category which accounted for only 3% of all growers. Analysis in Section 2.6 shows that older growers in New York tended to assess training as more worthwhile.

Educational background. New York growers were the best educated of the five states, with 87% having completed high school and 45% having had some post-high school education; these figures compare with the five-state averages of 80% and 36%, respectively. Exhibit 1-2 shows that New York had a particularly high percentage of college graduates (27%) as well as the lowest percentage of respondents with less than a high school education (14%). As we will show later in this chapter, the impacts of training on the growers' behavior were significantly correlated with age in New York.

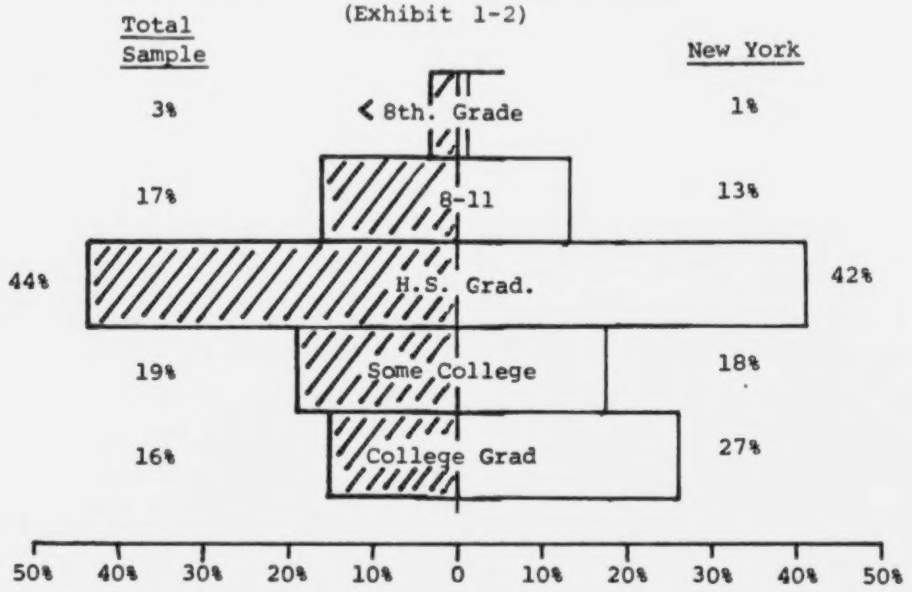
RESPONDENTS' AGE

(Exhibit 1-1)



LAST YEAR OF SCHOOL COMPLETED

(Exhibit 1-2)



Experience with pesticides. It is interesting to note that although New York growers were slightly younger than those of the other states, they were slightly more experienced in pesticide use than the average grower in the survey. Exhibit 1-3 displays that 38% of New York growers reported having 21 years or more experience compared to 33% for the entire sample. Only 6% of the New York sample had less than four years of experience, and this percentage was the same for all growers in the study.

Exhibit 4.1-2 in the Comprehensive Evaluation displayed similar data as a function of total responses in the five state study. Since here we are reporting on the percentage of New York respondents who reported particular crops and pests, the comparative percentages may vary as the more discrete subcategories and crop and pest combinations are presented.

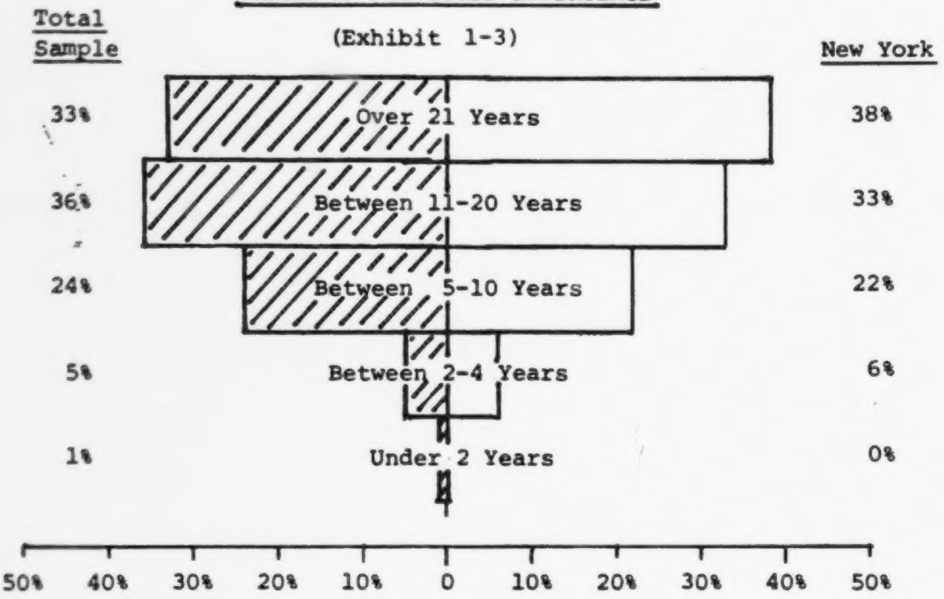
Principal crops and pests. Growers were asked to name their most important and second most important crops. Their responses are summarized in Exhibit 1-4. The most important crops, accounting for almost three-fifths of the New York respondents, were corn (37%) and fruit (22%). These were followed in approximately equal percentages by wheat (13%), grass (12%), and oats (10%). Leading secondary principal crops were grass (32%), fruit (17%), and oats (16%).

New York's percentage of respondents reporting fruit as a primary crop far exceeded that of the five state sample. New York's fruit production has particular significance to the state pesticide applicator training program since virtually all fruit crops require the application of one or more restricted pesticides, most notably azinphos methyl and carbofuran, both on the Environmental Protection Agency's restricted list since 1978. Parathion is also used.

The considerable percentage of New York growers who reported corn as their primary principal crop also has important implications for New York's training program, since New York state restricts many additional pesticides that are not restricted by EPA. An example is terbofos, which is used to control rootworm. Because of the volume of corn grown, weeds

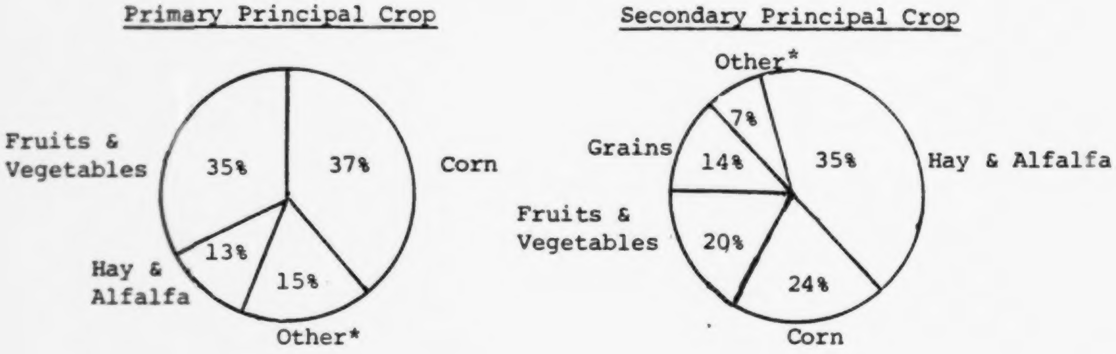
YEARS OF PESTICIDE EXPERIENCE

(Exhibit 1-3)



PRINCIPAL CROPS

(Exhibit 1-4)



*Other includes: Flowers; trees; grass; animals; wheat and other grains; and soybeans

Other includes: Flowers; trees; grass; animals; and soybeans are considered the primary pest in New York by 39% of all respondents. Twenty-five percent reported insects as a primary problem, and only a few (4%) reported plant diseases as the primary pest, as shown in Exhibit 1-5. Nearly 15% of the respondents reported insects, weeds, and plant diseases to be of equal degree as principal pest problems.

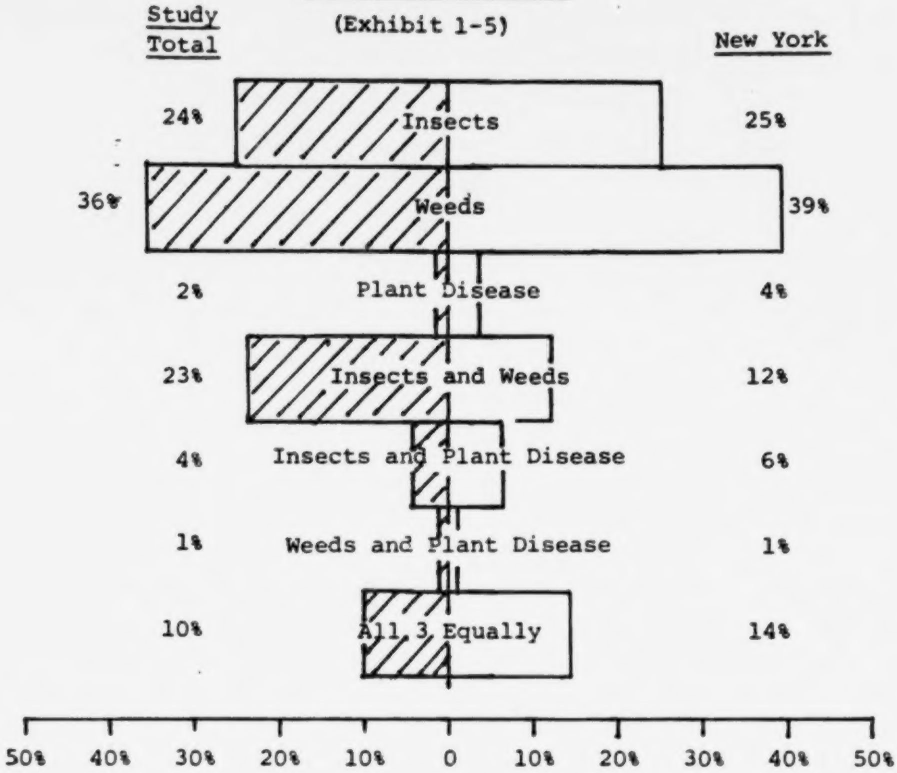
Farm size, frequency of pesticide application, and pesticide expenditures in 1980. These three background characteristics are discussed jointly because of the dramatic dichotomy between these characteristics as reported by the "eastern" growers (New York, Pennsylvania, and Georgia) and the "midwestern" growers (Nebraska and Iowa).

Sixty-two percent of New York growers operated farms of more than 100 acres, with nearly half of them farming between 100 and 500 acres. Exhibit 1-6 shows the striking difference in farm sizes between New York and the study averages. While farms of New York growers are about equal in size to those of Georgia and Pennsylvania, they are much smaller than either Nebraska's or Iowa's. Subsequent analysis in Section 3.2 discusses the correlations existing between farm size and pesticide-related behavior.

Given the difference in farm sizes between the eastern and western states, it is not at all surprising that the eastern growers--due to farming considerably less acreage (per grower) while raising a greater variety of crops--apply pesticides more often than growers in the mid-western states, where a great deal of acreage is applied with pre-emergent pesticides at the beginning of the growing season. The percentage of growers that apply pesticides more than five times a year was greatest in New York (47% compared to the five-state average of only 31%). One-fifth of New York respondents reported making a single application last year, a proportion similar to the entire sample norm of 23%. In addition, 6% of all growers in the survey reported never personally making an annual application of restricted pesticides (in the last three years) despite their training and certification as private applicators. Exhibit 1-7 illustrates a comparison between the application frequency among New York's growers and the sample as a whole.

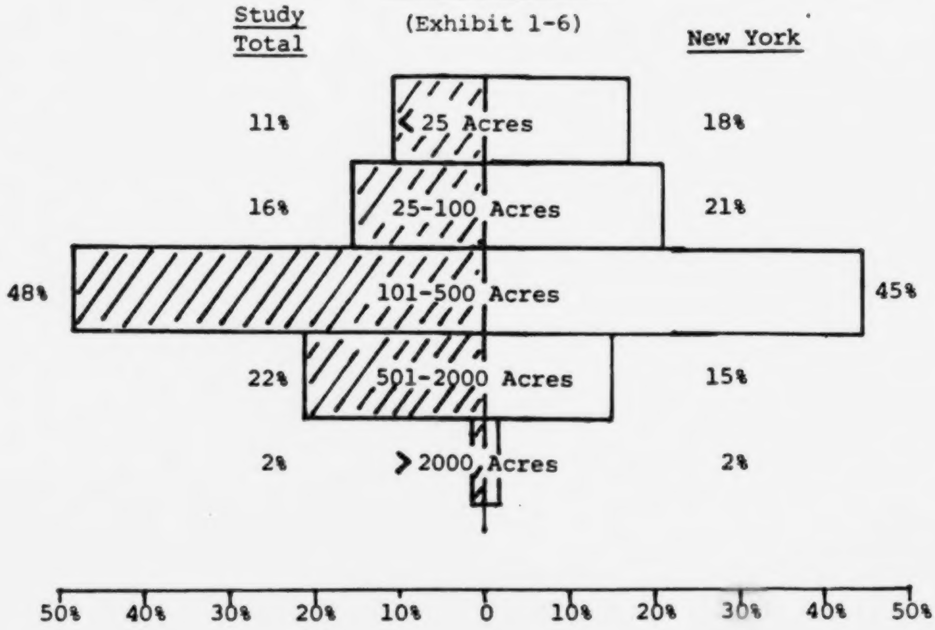
PRINCIPAL PESTS

(Exhibit 1-5)



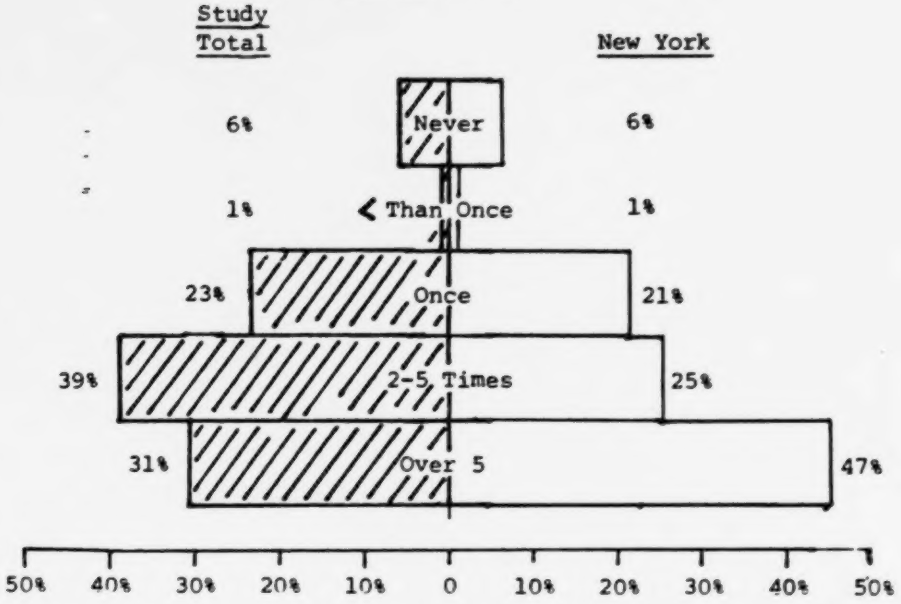
ACRES FARMED

(Exhibit 1-6)



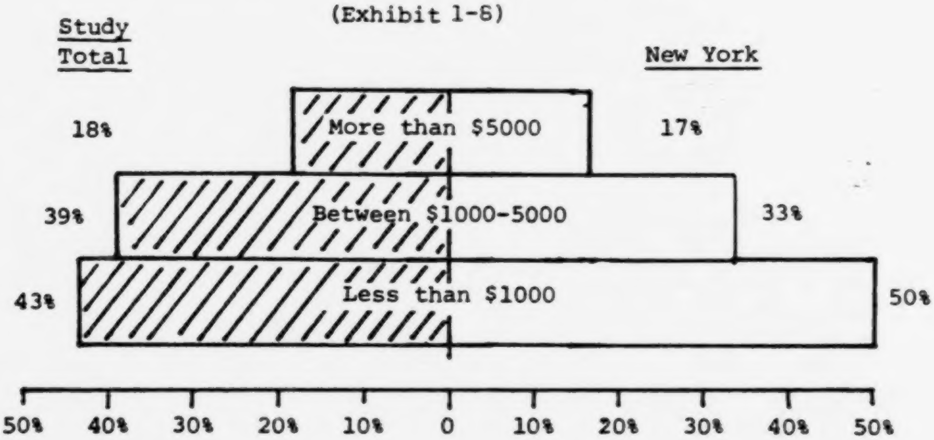
PESTICIDE APPLICATIONS PER YEAR

(Exhibit 1-7)



PESTICIDE EXPENDITURES LAST YEAR

(Exhibit 1-8)



New York growers were divided equally between those who reported spending more than $1,000 on pesticides last year (1980) and those who reported spending less than $1,000. While Georgia and Pennsylvania growers reported spending somewhat less than New York's respondents, all three of these states' expenditures were comparable overall. For this reason, the data for New York expenditures does not differ greatly when compared to the five-state total displayed in Exhibit 1-8.

2.0 ANALYSIS OF TRAINING PROGRAM CHARACTERISTICS

As mentioned in Section 1.1, the survey of trained and certified private pesticide applicators in New York resulted in a representative cross-section of ages, crop diversity and farm size. All growers in the survey were asked a series of questions regarding their attitudes toward the training and certification program, including their perceptions of its advantages an disadvantages. While some of the questions were designed to assess the grower's overall reaction to the program, and were therefore general in nature ("Overall, how worthwhile did you find the state private applicator training program to be?"), most survey questions were specific and focused on the grower's assessment of individual training elements (slide/tape presentation, manual, etc.) as well as their attitudes towards the value of certification and recertification. In addition to providing a description of the organization and format of New York's training and certification program, the following sections present a comprehensive discussion of the growers' responses to questions about the overall worth of the training and certification program. Section 1.3 then analyzes the growers' responses to questions which focus on the influence training had--or did not have--on their pesticide-related behaviors.

2.1 Program Description and Overall Assessment

The New York State Pesticide Training and Certification Program for private applicators was one of the first such programs in the country. The program has remained relatively unchanged since its inception in 1975, including its subject matter, training materials, format and organization.

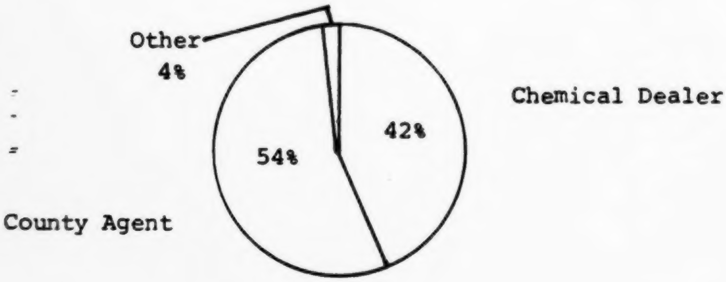
There are two key organizations which administer and coordinate the program in New York. The first is the County Cooperative Extension Service administered through the Chemical-Pesticides Program of Cornell University's College of Agriculture and Life Sciences. The Chemical-Pesticides Program is responsible for coordinating the training sessions among the 62 counties in the state, and plays an instrumental role in the design and implementation of the program, including the selection and design of training materials. The Chemical-Pesticide Program office communicates directly with the county agents who conduct the training sessions. Trainers were originally selected on the basis of their background and experience in pesticide usage, in addition to their knowledge of the county's individual agricultural-environmental characteristics and needs. When growers in the survey were asked to name their primary source of assistance for pesticide-related information, over half (54%) of the New York respondents reported their County Extension agent as their most likely choice, while 42% reported seeking advice from their chemical dealer. Exhibit 2-1 illustrates the source to which the New York respondents are most likely to turn for pesticide assistance.

The New York State Department of Environmental Conservation/Bureau of Pesticides (BOP) is another key organization which shares responsibility with the Cooperative Extension Service (CES) for the state's pesticide applicator training and certification program. While the CES is responsible for training, the BOP designs and administers certification examination procedures. Under the direction of the State Lead Agency, the BOP operates nine regional offices which send inspectors, when needed, to appropriate training and testing sites throughout the state. The BOP is also responsible for recordkeeping and recertification notification.

Training format and materials. CES conducts the training program in two sessions. In the first meeting, trainees complete record forms, obtain a copy of the Northeastern Core Manual and view a 22-minute film on pesticide safety, based on the Northeastern Core Manual. The Core Manual is more detailed than the Environmental Protection Agency's Core Manual. Topics emphasized within it include laws and regulations, toxicity and safety, labels, formulations and mixing; and disposal and storage.

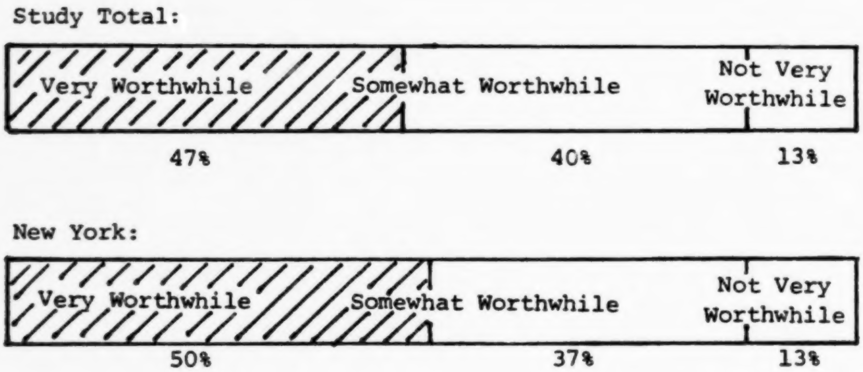
SOURCE OF PESTICIDE ASSISTANCE

(Exhibit 2-1)



PERCEIVED WORTH OF TRAINING

(Exhibit 2-2)



The second training session occurs three to four weeks after the initial meeting and after study of the manual. Trainees meet to discuss the Core Manual with their county agents and to view a 20-minute slide/tape series which emphasizes accident avoidance procedures contained in the Manual. Following the slide presentation, trainees are given a 25-question "trial exam" designed to review problem areas. After the county agent has reviewed the trial-exam, a DEC inspector administers and grades the New York State Certification Exam, which contains fifty questions.

A modest but gradually increasing number of applicants have chosen to be certified through the state's self-study training program. This entails receiving a copy of the Northeastern Core Manual from a county agent, studying it, and then taking the certification exam either at a regularly scheduled session or by private arrangement with a DEC inspector. Whether they receive formal training or self-study, all certification applicants must pass the state exam in order to achieve certification. In the early years of New York's Training-Certification program, less than 5% of all applicants opted for self-study; 12% of the New York respondents in the current study reported being trained by self-study.

New York requires certified applicators to have their certification "renewed" every three years. This procedure requires filling out a renewal form and paying a $15.00 fee the renewal being good for 3 years. No substantive pesticide-related exercise or requirements are necessary. Recertification, however, is a more rigorous process and is required every six years. New York's initial deadline for recertification is the Fall of 1984. Currently, DEC and CES officials are completing the final design of a Pesticides Safety Recertification Workbook which every certified grower will be required to complete and returned to DEC for approval. Respondent assessment of certification and "recertification" is provided in Section 2.4, although in New York it should be remembered that any reference to "recertification" is actually reference to certification renewal since recertification of private pesticide applicators initially trained and certified is not expected until 1984.

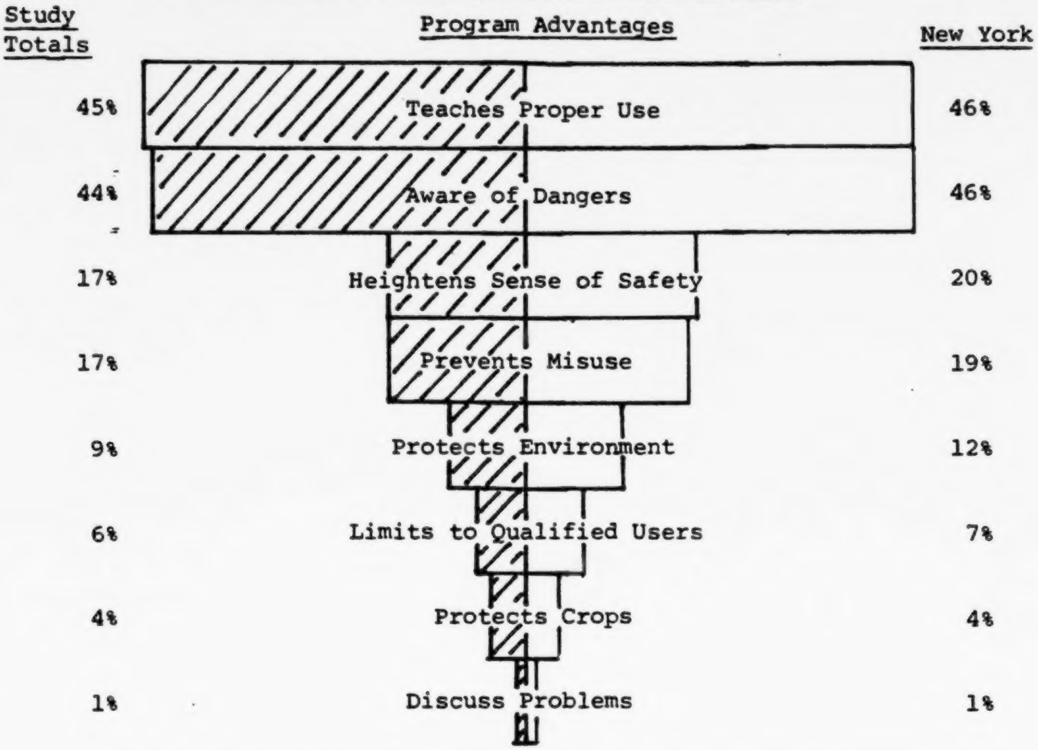
Growers' Assessment of Training. Eighty-eight percent of the 409 respondents in the New York survey reported that they attended training sessions. The remaining 12% were certified by self-study. When asked to rate the overall worth of training as either "very worthwhile," "somewhat worthwhile," or "not worthwhile," half of the New York growers considered training to have been "very worthwhile," while slightly over one-third believed training was only "somewhat worthwhile." Exhibit 2-2 compares New York growers' overall training evaluation with the five-state average. As shown, New York growers responses to the question were quite comparable to the entire survey sample.

2.2 Advantages and Disadvantages of the Program

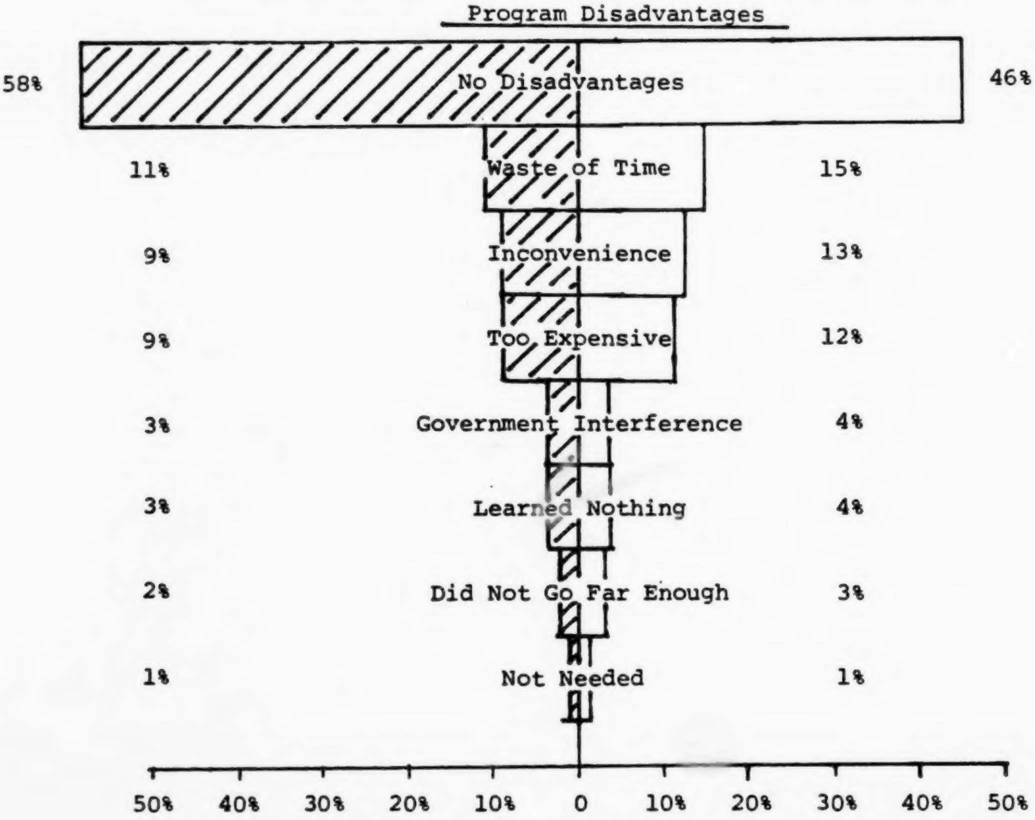
When asked to cite what they believed were the advantages and disadvantages of the training, New York growers responded that the training's greatest advantages were: 1) making growers aware of pesticide dangers (46%), 2) informing growers of the proper use of chemicals (46%), and 3) making growers aware of safety (20%). Since respondents were not given a list of responses from which to choose, the frequencies of certain "open-ended" responses are meaningful. For example, a significant percentage of the growers emphasized the value of the training in making growers aware of the dangers involved in chemical-pesticide application, and that proper safety measures should be employed when using pesticides. Exhibit 2-3 shows that almost half of all respondents (both in New York and the five-state group) listed "awareness of dangers" and "proper use" as the greatest advantages. "Preventing misuse" was also considered a key advantage of training, as it was listed by nearly one-fifth of both New York growers and the entire sample as well.

New York growers tended to rate environment and wildlife protection higher than any other state, with 12% of those growers surveyed citing this as a program advantage. The environmental safety considerations are stressed in the New York training program.

ADVANTAGES AND DISADVANTAGES OF THE STATE PRIVATE APPLICATOR TRAINING AND CERTIFICATION PROGRAM (Exhibit 2-3)*


Program Advantages

*Note: Percentages for this exhibit need not total 100%)

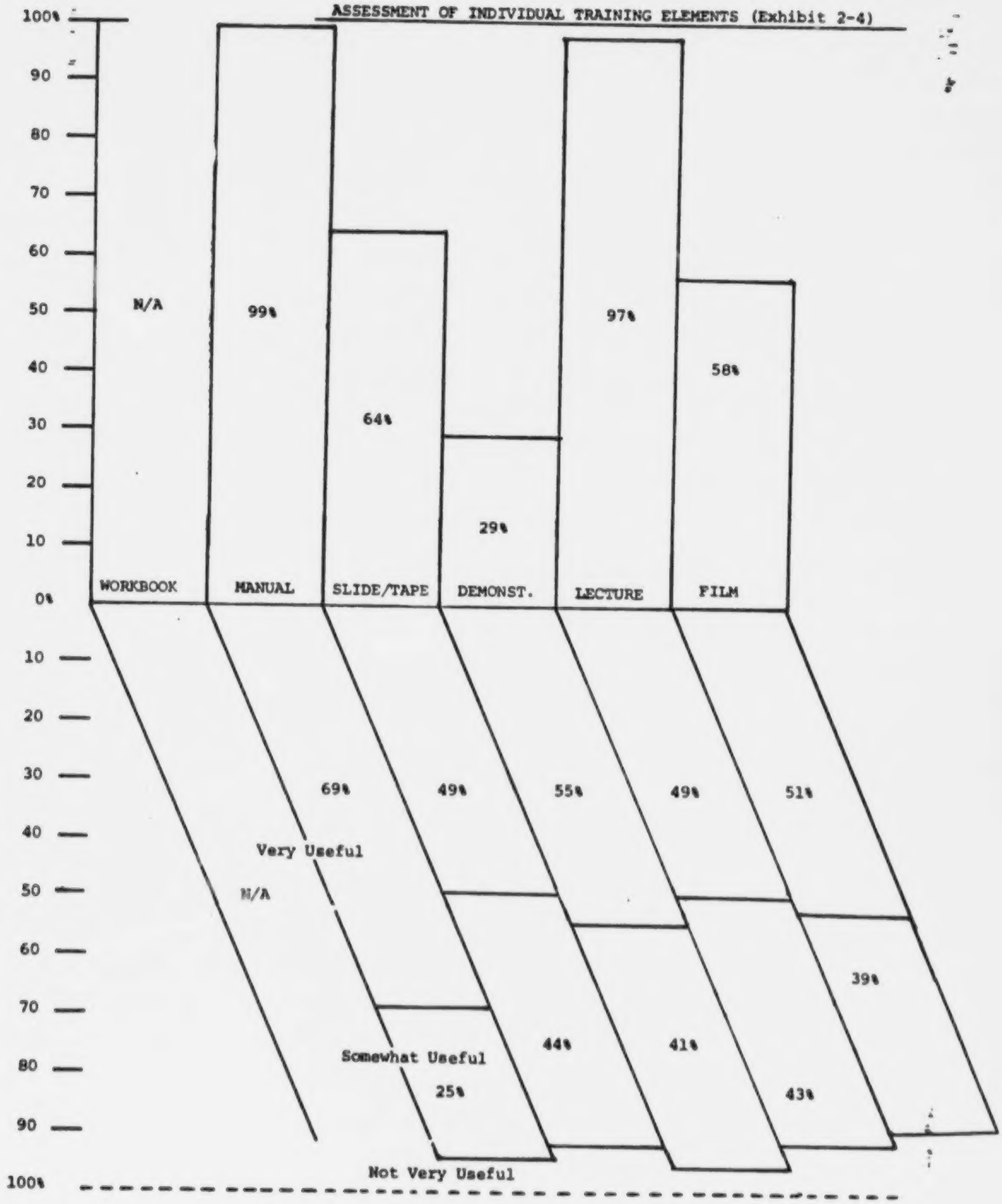

Program Disadvantages

New York growers perceived, on the whole, more program disadvantages than did the five states as a whole; only 46% of New York respondents cited "no disadvantages" as compared with 58% of the total sample. This was largely due to the percentage of New Yorkers who listed "inconvenience," (13%); "waste of time" (15%); and "too expensive" (12%) as disadvantages. Exhibit 2-3 shows that while all states listed these factors as the leading disadvantages of their respective training programs, a significantly greater proportion of New York applicators cited these particular disadvantages. New York's two-session program requires a greater investment of a grower's time than do any of the other programs, and it also requires more money in fees ($6.00 for a training manual, $15.00 to certify, and $15.00 for a three-year renewal).

2.3 Assessment of Individual Training Elements

Each grower in the survey was asked to list the various training materials and methods used in his training session. One or more of six primary training elements were used in each of the five states participating in the survey: 1) slide/tape presentation, 2) film presentation, 3) demonstration (calibration, label comprehension, etc.), 4) lecture, 5) training manual, and 6) workbook. The New York Training Program incorporates all of these elements in its training format (see Section 2.1) except that there is no workbook. The only element used by New York that is not used by any other participating state is a film presentation.

In addition to identifying the materials used in their training session, growers were asked to consider the "usefulness" of each material--was it "very useful," "somewhat useful," or "not very useful?" Exhibit 2-4 is a comprehensive graphic display illustrating the New York growers' response to these questions. The upper half of Exhibit 2-4 summarizes the percentage of growers in New York that reported using the various training elements. The bottom half of Exhibit 2-4 displays the "usefulness" rating for each element. As shown, training elements (except demonstration) were used by at least half of all respondents, the most frequently utilized elements being a lecture or a manual which were reported by 97% and 99%, respectively, of all New York respondents. (About nine out of ten growers who had attended training sessions responded that they had used a manual, while only 11% of self-study respondents reported using a manual.)



ASSESSMENT OF INDIVIDUAL TRAINING ELEMENTS (Exhibit 2-4)

Since all six training elements are considered to be standardized materials of New York's program, it is somewhat surprising that a larger percentage did not report having used the slide/tape series or film. One possible explanation is simply that the growers could not recall the individual elements used in their training since most of the respondents were trained in the 1977-1978 timeframe, or even earlier. It is also possible that individual Cooperative Extension agents chose to spend more time emphasizing particular elements, thereby eliminating certain methods in favor of spending more time on others.

For each training element, nearly half of all the growers that used the material reported that it was "very useful" in training. Clearly, growers considered the Northeastern Core Manual to be the most useful element with 69% reporting it as "very useful." This was the highest "usefulness" rating given to a training manual by any group of growers in the five states. For all states, the average percentage of respondents rating the manual as "very useful" was 54%.

2.4 Initial Certification and Assessment of Certification

When asked to state their perceived importance of a private pesticide application training and certification program--as either "very important," "somewhat important," or "not very important"--growers' responses were very similar to their perceptions of the worth of training. Exhibit 2-5 illustrates this. Half of all New York growers considered certification to be "very important," one-third indicated that it was "somewhat important," while the remaining 14% considered certification to be not very important. On average, growers from all states responded comparably.

Exhibit 2-6 displays the distribution of trainees in the New York survey by year of initial certification. A substantial plurality of the growers reported their initial certification year as either 1977 or 1978. It is important to note that many of these growers were probably trained in 1975 or 1976, but because of administrative lags between training and certification, a later certification date was recorded by DEC. It is also important to note that one-quarter of the respondents could not remember the exact year of their certification.

PERCEIVED IMPORTANCE OF CERTIFICATION AND OVERALL WORTH OF TRAINING (Exhibit 2-5)

IMPORTANCE OF CERTIFICATION

Very Important	Somewhat Important	Not Very Important
52%	34%	14%

OVERALL WORTH OF TRAINING

Very Worthwhile	Somewhat Worthwhile	Not Very Worthwhile
50%	37%	13%

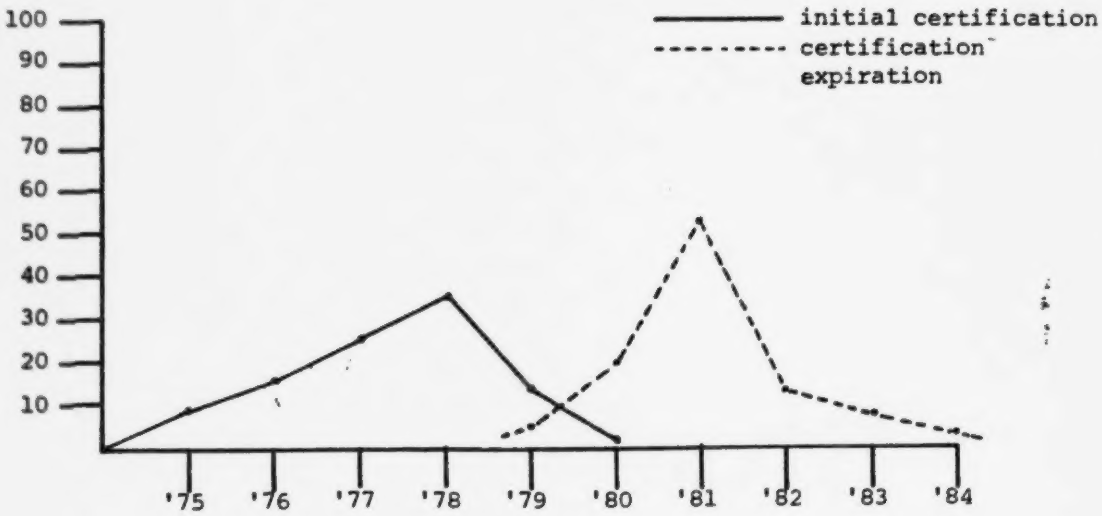
(Exhibit 2-6)

YEAR OF INITIAL CERTIFICATION

1975: 9%
1976: 15%
1977: 25%
1978: 35%
1979: 14%
1980: 2%

YEAR OF CERTIFICATION EXPIRATION

1979: 4%
1980: 20%
1981: 51%
1982: 12%
1983: 8%
1984: 3%
1985: 2%



When asked to give the year in which their initial certification expires, growers responded as also shown on Exhibit 2-6. The data in Exhibit 2-6 are surprising because the earliest possible official certification expiration date for New York growers is 1984, a date given by only 2% of the respondents. The discrepancy is probably due to the growers' confusing the state's certification renewal requirement with the recertification requirement.

2.5 Recertification Status and Assessment of Recertification

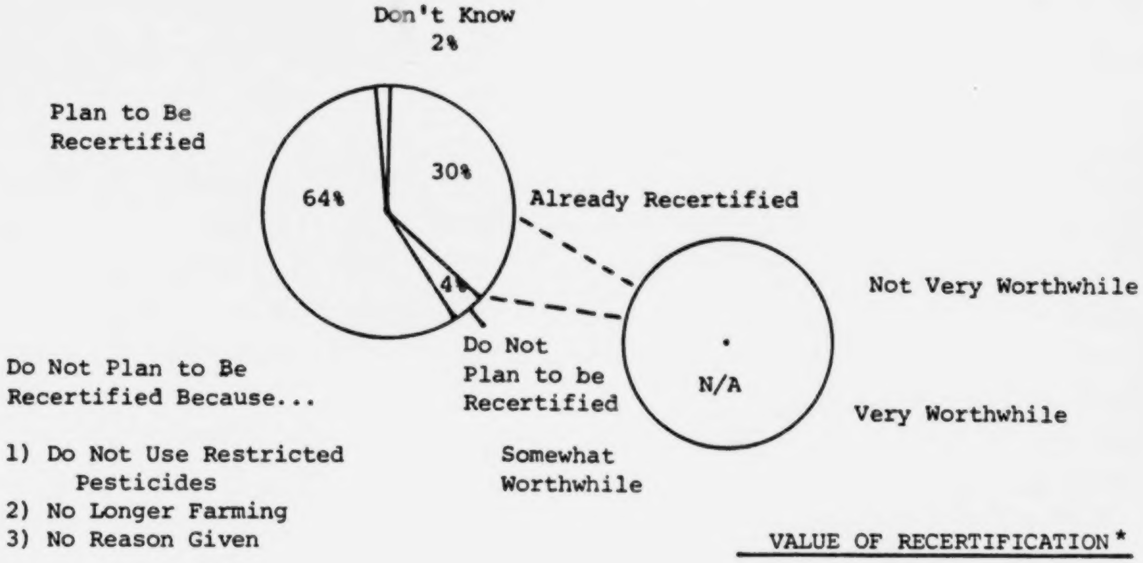
Exhibit 2-7 displays the recertification plans of the New York respondents. The assessed value of recertification by those who reported already completing the program has been omitted. A small percentage of respondents answered this question, and these were under the mistaken belief that certification renewal and recertification were the same requirements. (Recertification does not begin in New York until 1984.) The 30% reporting having been recertified possibly more accurately reflects those who had their certification renewed, although there is no way these responses can be verified. (Respondents were clearly confused as to whether recertification was the same as certification renewal).

The majority of respondents (64%) indicated that they plan to be recertified and only 4%--the smallest percentage among the states in the study--indicated that they do not plan to be recertified. Although the reasons for not recertifying were infrequently given, "no longer farming" or "do not use restricted pesticides" was offered by the few respondents who did provide reasons. Given the number of restricted pesticides in New York, recertification is an obvious prerequisite to farming in the state, and most active growers can be expected to seek recertification when it is offered.

2.6 Training Assessment by Background Characteristics

This section discusses the growers' overall assessments of the value of training by various background characteristics. Growers' assessments were cross-tabulated with the following:

RECERTIFICATION PLANS (Exhibit 2-7)



*Respondents in New York obviously were confusing certification renewal with recertification (which is not expected to begin until 1984). The results concerning "recertification," therefore, actually speak only to the certification renewal process (which does not encompass any additional training).

- farm size
- education
- age
- years of pesticide experience
- annual pesticide expenditures
- frequency of pesticide application

Since the growers in the sample were not equally divided within each subcategory (for example, only 17% of the growers farmed more than 501 acres while 38% farmed less than 100 acres), correlations were tested for statistical significance. Spearman nonparametric correlation coefficients were computed. All coefficients presented here are significant at the .95 confidence level.

The survey revealed that those growers who considered training to be "very worthwhile" tended to be older (r=.09); less educated (r=.07); own smaller farms (r=.11) have less experience with pesticides (r=-.08); and spent less each year on pesticides (r=-.14). These background characteristics are indicative of the type of grower who probably does not have many other sources of information regarding pesticide usage and therefore stands to benefit most from training. Less educated growers, for example, are not likely to read agriculture journals, nor is it probable that they would have acquired training information in a classroom. Those farmers who own smaller farms and spend less on pesticides are possibly not as familiar with large-scale, agribusiness technology.

3.0 ANALYSIS OF BEHAVIORAL CHARACTERISTICS

Respondents were asked to provide information on whether or not they perceived any differences since training in eleven major areas of pesticide-related behavior. Training impacts were assessed in the following 11 behavioral areas:

1. methods of pest identification
2. amount of crop damage allowed
3. methods of pesticide transportation
4. clothing worn while mixing and loading pesticides
5. frequency of equipment calibration
6. clothing worn while spraying pesticides
7. methods of drift prevention
8. methods of handling spills
9. methods of handling leftovers
10. methods of equipment and pesticide storage
11. methods of pesticide container disposal

The survey used a "non-leading," two-question approach to determine behavioral impact. Growers were first asked if they felt there were "differences in the methods they used since training to [transport pesticides, mix and load, etc.] that resulted from their participation in the state training program;" second, they were asked to describe specific difference(s). If the respondent reported no differences since training, he was asked to describe his current pesticide use and training practices related to that behavioral area (for 8 out of the 11 behaviors listed above).

Section 3.1 which follows discusses the degree and type of each behavioral impact in detail. Subsequent sections present correlations of reported behavioral impacts by background characteristics (Section 3.2) and by training characteristics (Section 3.3). Finally, Section 3.4 discusses the behavioral practices of those respondents who reported that their training did not affect their behavior.

3.1 Reported Behavioral Impacts

Exhibit 3-1 displays the number of reported behavioral areas impacted as reported by the New York respondents and study respondents as a whole. As can be seen from the exhibit, nearly three out of four of the New York respondents reported being impacted in at least one behavioral area (74%) and at least one-third reported being impacted in four or more behavioral areas. When compared to study respondents as a whole, New York respondents reported average numbers of behavioral areas impacted.

Exhibit 3-2 indicates the specific behavioral impacts reported by the New York growers in comparison with study respondents. The New York growers reported higher than average impacts in the areas of transportation; clothing worn while mixing and loading pesticides; clothing worn while spraying; handling leftovers; and pesticide and equipment storage. None of these impacts were statistically significantly greater than the average for all five states.

In the following subsections, each of the eleven behavioral areas are discussed in terms of reported impacts, with particular emphasis on the specific differences cited by respondents in their pesticide handling and use practices since training. References to total impacts within each category correspond to those displayed on Exhibit 3-2.

3.1.1 Pest Identification and Crop Damage Allowed

Twenty percent of all interviewed growers in New York and 20% of the sample total reported that their training had an impact on the method(s) they used to identify pests. This percentage, in fact, represents the smallest number of growers affected for any single behavior area in New York as well as in the five-state sample average. When asked to describe the manner in which their behavior was affected, 5% reported that they were better informed and more able to identify pests; 2% inspected pests more closely; 2% now check with their county agent; another 2% are more careful in matching the correct pesticide to the pest; and 5% of all growers reported using other methods such as a pest management program or more judicious spraying.

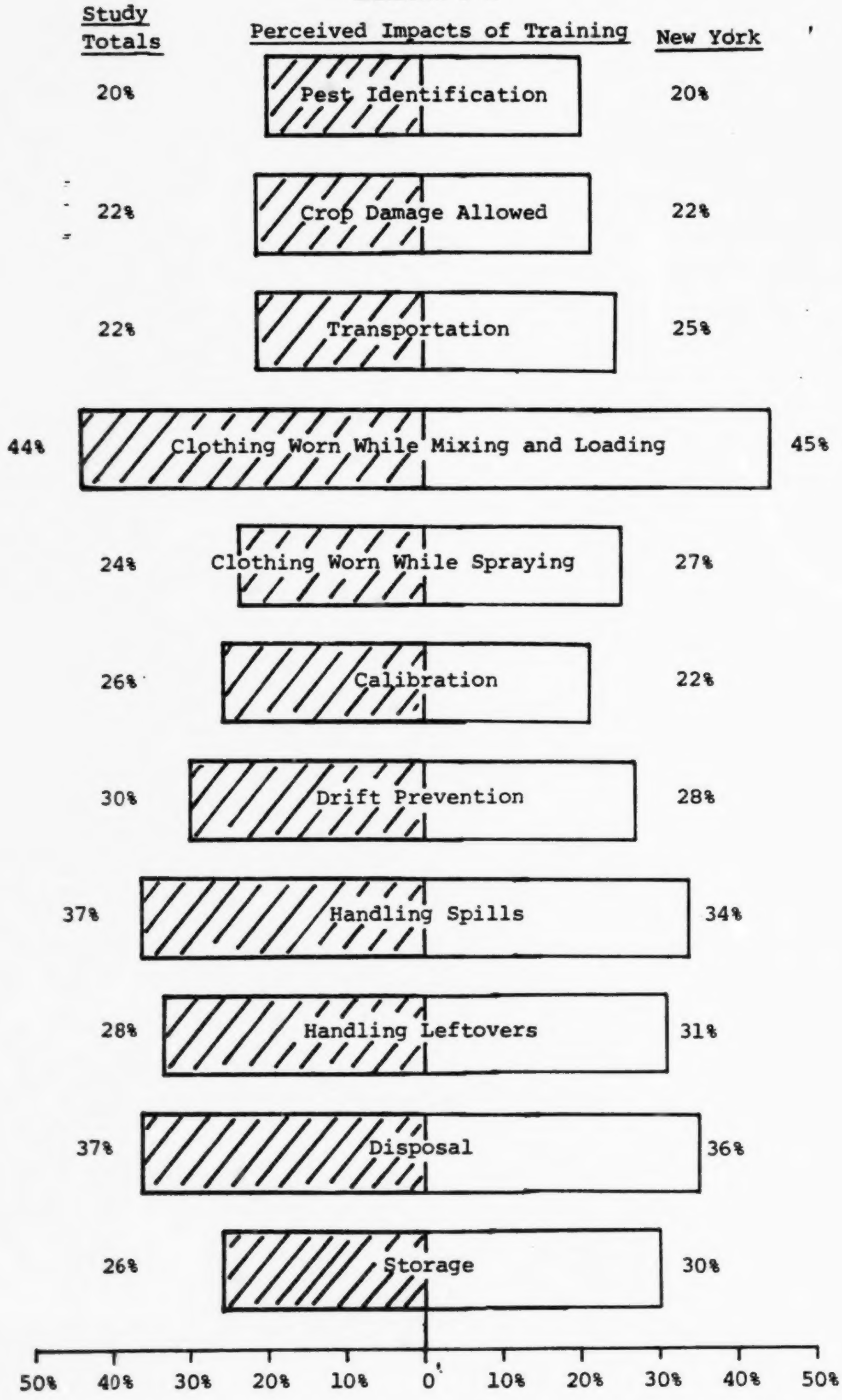
Exhibit 3-1

Number of Reported Behavioral Areas Impacted

Number of Behavioral Areas Impacted	New York		Study Total	
	Relative Frequency	Cumulative Frequency	Relative Frequency	Cumulative Frequency
0	26%	26%	24%	24%
1	10	36	13	37
2	12	47	11	48
3	12	59	11	59
4	11	69	10	69
5	8	78	9	78
6	7	85	7	85
7	5	90	5	90
8	5	94	4	94
9	4	98	3	97
10	1	99	2	99
11	1	100	1	100

Exhibit 3-2

Perceived Impacts of Training



When asked if their training had influenced the amount of crop damage they allow before applying pesticides, 22% of New York's growers replied that it had compared to 22% of the total sample. Compared with the degree of impact on eleven surveyed behaviors areas, this percentage was also a relatively low figure (see Exhibit 3-2). Six percent of all growers (1/3 of the growers that reported a behavior change in allowable crop damage) said they allow more damage before applying pesticides, while 4% reported allowing less damage since being trained. A variety of other differences (7%) including "greater awareness" and "more attentive" were reported by the New York sample.

3.1.2 Pesticide Transportation

One-quarter of the New York growers reported a change in the method they use to carry pesticides in their car or truck as a result of training. The growers' most commonly reported behavioral differences was that they are now generally more careful (11%). Other growers, however, did report specific transportation safety measures taken as a result of training, such as keeping pesticides in closed containers (7%), keeping pesticides in the car trunk or truck bed (5%), keeping pesticides away from the driver (3%) and keeping pesticides away from children and animals (1%).

3.1.3 Pesticide Mixing and Loading

Growers were asked if there were any differences since training in the clothing or protective equipment they wear when mixing and loading pesticides that have a skull and crossbones on the label. More growers reported a behavioral influence due to training in this category than in any other behavioral category, both within New York and in the entire five-state sample, 45% and 44% respectively. Thirty-five percent of New York's respondents reported that they now wear waterproof (or rubber) gloves as a result of training; 29% now wear a respirator or mask; 15%

wear a raincoat or rainsuit, and 10% began wearing goggles or protective glasses after training. Other clothing that was reported by New York respondents to be worn as result of training, although to a lesser degree, included waterproof boots, long-sleeved shirt, and long trousers or coveralls. As will be discussed further in Section 3.4, New York growers wear more protective gear than growers in other states, and report doing so since training.

3.1.4 Equipment Calibration

The survey sought to determine if training had an impact on the frequency with or methods by which growers calibrate their equipment. In New York, 22% of the growers answered that training had had an impact in this area. This represented the lowest impact in this area of any of the five participating states, and this problem is discussed further in Section 3.4. Most of those growers who reported differences since training said that they calibrate more carefully (9%); or are generally more careful in their measuring procedures or in following instructions (7%). Only 3% of all New York growers reported that they calibrate more often.

3.1.5 Pesticide Spraying and Drift Prevention

As in the case of mixing and loading, New York growers were asked to name all outer clothing and other protective equipment they wear--as a result of training--while spraying pesticides with a skull and crossbones on the label. Twenty-seven percent of New York's growers reported a training impact in this behavioral area since training. While this figure represents a considerably lesser degree of training influence than was reported in the area of clothing worn while mixing and loading, the most frequently mentioned individual articles of clothing are the same: 14% of the growers reported wearing waterproof (or rubber) gloves, 19% now use a respirator, filter mask (which includes charcoal cartridge, vapor, or nose masks) or dust mask, and 10% wear a raincoat or rainsuit as a result of training.

In another question related to spraying behavior, growers were asked if training had influenced the methods they used to prevent spray drift. Twenty-seven percent of the New York growers responded that it had. The primary reported influence was that, since training, growers spray when the wind is low (20%). Other behavioral impacts on spraying methods such as "spraying with the direction of the wind," "spraying closer to the ground," "spraying at cooler times," and "using lower pressure" were each mentioned by 5% or less of respondents in New York.

3.1.6 Handling Spills and Leftovers

Growers were asked whether or not there was any difference since training in what they did if they spilled a small amount of the undiluted pesticide on their clothing or skin. A relatively large percentage of New York growers, 34%, replied that their behavior in this area had changed since training. When asked to name specific behavioral changes, 13% said they wash more quickly, the same percentage said they wash more thoroughly, and 9% of New Yorkers said they remove their clothing. Four percent of growers reported that they are more likely to call a physician; 2% reported being more likely to read the label; and 5% reported being more careful in general as a result of training.

When asked if training influenced what they do with leftover pesticide, 31% of New York growers replied that training had affected their behavior. As with behavior related to mixing and loading and handling spills, this is a relatively large impact area. It is comparable to the study average in which 28% of growers said that they handle leftovers differently since training. A variety of behavioral changes were reported by the New York growers, although the most common one (reported by 10%) was that they now store their leftovers in a closed container. Again, this was most common for growers in all five states. Other changes in New York growers' behavior in handling leftover pesticides were reported with comparable frequency: 3% of growers reported draining or burying leftovers, 3% don't have any leftover (perhaps due to more judicious application), while less than 1% said they take their leftovers to a dealer. (It should be noted that draining or burying the pesticide into the ground is not currently a recommended method, but it was an approved method in the EPA core manual when training programs first began.)

3.1.7 Pesticide Storage and Disposal

Thirty percent of the New York growers reported that they store their pesticides and equipment differently since training. A majority of methods cited were security oriented, designed to keep untrained persons or animals away from pesticide-related items. For example, 14% of New York respondents reported keeping their items locked-up since training; 13% said they now keep them in a special, separate shed; and 8% replied that they are especially careful to keep their pesticides and equipment away from children and animals. Other, less common reported training impacts on storage behavior included washing or cleaning equipment before storage (3%) and storing pesticide items away from extreme heat (3%).

More than one-third of New York's growers stated that they dispose of their empty pesticide containers differently since training. This relatively large impact is probably partially due to the emphasis placed by New York's Training Program on environment and wildlife preservation. Citing specific disposal methods resulting from training, 14% of growers said they bury their empty pesticide containers, 8% burn them, 8% rinse them and 7% haul them to a landfill, while only 5% take their empty containers to a dump, generally considered an unacceptable practice. Many growers reported using more than one disposal method.

When considering the New York growers' perceived behavioral impacts of training across all eleven areas, it becomes evident that training had the most influence in those areas which involved direct, immediate handling or exposure to pesticides and posing a personal health hazard. These behaviors include clothing worn while "mixing and loading," "handling spills" and "disposal" (see Exhibit 3-2). "Handling leftovers" behaviors were considerably affected as well. Conversely, those behaviors which are not as likely to lead to direct skin contact or ingestion were consistently perceived by the growers to be least affected by training. Specifically, these include "pest identification," "crop damage allowed," said "calibration".

3.2 Reported Behavioral Impacts by Background Characteristics

This section discusses whether or not the behavioral impacts that were perceived by the growers to have resulted from training are in fact significantly correlated with the various demographic and agricultural background characteristics of the growers. The characteristics considered here are age, education, years of pesticide experience, the number of acres farmed, the number of pesticide applications per year, and pesticide expenditures last year. All correlations, measured by Spearman nonparametric correlation coefficients, were tested for significance at the 95% confidence level. Exhibit 3-3 displays correlations between the number of behavioral impacts reported by New York respondents and their background characteristics. Only those who apply pesticides more frequently tended to be more strongly influenced by training (r=.10) in New York. Exhibit 3-4 breaks out the correlations for individual behavioral areas. It is important to note that these correlations apply only to those growers who reported that their behavior did change as a result of training. Correlations involving nonimpacted respondents are discussed in Section 3.4.

In the following section, each background characteristic is correlated with specific reported behavioral impacts to examine which respondents were more or less likely to be affected in each of the eleven behavioral areas examined.

Age. Correlations exist between New York growers' ages and their reported changes since training in two impact areas. The older growers had a slighter greater tendency than the younger growers to take greater care in the areas of handling pesticide spills (r=.09) and disposal (r=.11) as a result of their training. In other behavior areas, no significant correlations exist, implying that training is no more likely to affect either older growers or younger growers.

Education. Here, no significant associations were discovered for any of the pesticide-related behaviors. This is particularly interesting since New York growers were the best-educated group in the five-state sample, 27% of them holding college degrees. The implication is that New York's training program affects all growers equally, regardless of level of formal education.

Exhibit 3-3

Number of Behavioral Impact Areas with Reported Changes by Background Characteristics

	New York	Total Sample
Age	a	a
Education	a	.06
Farm Size	a	.06
Years of Pesticide Experience	a	a
Frequency of Pesticide Application	.10	.07
Pesticide Expenditures, 1980	a	a

[a] Indicates correlations are not statistically significant at the .05 level.

Exhibit 3-4

Correlation of Reported Behavioral Impacts by Background Characteristics

	Pest Identification	Crop Damage Allowed	Transportation	Clothing While Mixing	Clothing While Spraying	Equipment Calibration	Drift Prevention	Handling Spills	Handling Leftovers	Pesticide Disposal	Pesticide Storage
Farm Size	a	a	-.10	a	a	a	a	a	a	a	-.17
Education	a	a	a	a	a	a	a	a	a	a	a
Age	a	a	a	a	a	a	a	.09	a	.11	a
Years of Pesticide Experience	a	-.09	a	a	a	a	a	a	a	a	a
Pesticide Usage per Year	a	a	.12	a	a	a	a	a	a	a	.14
Pesticide Expenditures Last Year	a	a	a	a	a	a	a	a	a	a	a

[a] Indicates correlations not statistically significant at the .05 level.

Experience with Pesticides. The only significant correlation between growers' experience using pesticides and reported behavioral impacts was in the amount of crop damage they would allow before applying pesticides (r=.09). The less experienced respondents were a bit more likely to change--as a result of training--the amount of crop damage they would allow.

Number of Acres Farmed and Number of Pesticide Applications per Year. Correlations were calculated separately for these background characteristics, but they are discussed jointly since they tended to be correlated with the same behaviors, specifically, transportation practices and storage procedures. There is a mild tendency for growers who own small farms (r = .10) and who frequently apply pesticides (r = .12) to have their transportation methods influenced by training, and there is an even greater tendency for these growers to use different storage methods (r = -.17 and .14 respectively) since training. It is logical that small farm owners who use pesticides often would: a) buy smaller quantities at any given time and subsequently are transporting pesticides more frequently; and b) not own sophisticated storage equipment or space. Thus, it is encouraging that this group of growers would take special care in heeding safety recommendations in these behavior areas.

Expenditures on Pesticides Last Year. As with educational background, no significant correlations exist between the amount of money a grower spent on pesticides in 1980 and specific behavioral changes resulting from training.

In the following section, the reported behavioral impacts of the New York growers are analyzed by a few key training characteristics to ascertain whether those respondents in different training circumstances were more or less impacted than others.

3.3 Reported Behavioral Impacts by Training Characteristics

The reported behavioral impacts of New York private applicators were examined to assess whether or not they were significantly correlated with four training characteristics: the year of initial certification, the type of training program (training or self-study), the growers' assessment of training worth; and the source of pesticide assistance (county agent or chemical dealer). Only the significant correlation coefficients (at the .95 confidence level) between training characteristics and the number of impact areas where changes were reported are summarized on Exhibit 3-5. The correlation coefficients for each behavior category are displayed on Exhibit 3-6.

Year of Initial Certification. As displayed in Exhibit 3-6, only two of the eleven behavior areas were found to be associated with the growers' certification date, and both of these were identical mild negative correlations ($r=-.11$). These correlations indicate that trainees who were certified in the early years of the program had a tendency to be more greatly influenced by training in the areas of handling spills and disposal. Overall, however, no correlation existed between certification date and impacted behavior.

Training vs. Self-Study. No correlation existed between this training characteristic and any pesticide-related behavior change. This is not a good test of the effect of training type, however, because of the small number of respondents in New York who chose the self-study method. Where respondents were divided more evenly by training type as in Pennsylvania, results are more statistically significant (see Appendix D for a discussion of the Pennsylvania results).

Assessment of Training Worth. Not surprisingly, there existed a definite correlation between growers' overall assessment of their training's worth ("very worthwhile," "somewhat worthwhile" or "not very worthwhile") and their perceptions of training's affect on their behavior in pesticide usage ($r=.35$). Significant correlations were discovered for all eleven

Exhibit 3-5

Number of Behavioral Impact Areas with Reported Changes by Training Characteristics

	New York	Total Sample
Year of Initial Certification	a	a
Training Type	a	a
Source of Pesticide Assistance	.13	.16
Assessment of Training Worth	.35	.33

[a] Indicates correlations are not statistically significant at the .05 level.

Exhibit 3-6

Correlation of Reported Behavioral Impacts by Training Characteristics

	Pest Identification	Crop Damage Allowed	Transportation	Clothing While Mixing	Clothing While Spraying	Equipment Calibration	Drift Prevention	Handling Spills	Handling Leftovers	Pesticide Disposal	Pesticide Storage
Year of Initial Certification	a	a	a	a	a	a	a	-.11	a	-.11	a
Training Type	a	a	a	a	a	a	a	a	a	a	a
Source of Pesticide Assistance	.10	a	a	.20	.20	.18	a	.12	.13	.11	a
Assessment of Training Worth	.30	.16	.26	.19	.19	a	.26	.24	.22	.21	.23

[a] Indicates correlations not statistically significant at the .05 level.

behavior categories, with particularly strong associations in pest identification (r=.30); transportation methods (r=.26); and drift prevention measures (r=.26). The overall implication here is that growers who considered their training as very worthwhile (half of all New York respondents) were more likely to report behavioral impacts since training.

Source of Pesticide Assistance. Slightly over half (54%) of the respondents in New York reported that the most likely source they used for assistance in pesticide-related matters is their county extension agent. This compares closely with the five-state sample in which exactly half of the growers go to their county extension agent. The other leading source of assistance is the grower's local chemical dealer. Forty-two percent of New York growers and 47% of all sample growers rely on their dealer as their primary pesticide information source.

Correlations were discovered between source of pesticide assistance and changes after training in six of the eleven behavior categories: pest identification (r=.10); handling spills (r=.12); handling leftovers (r=.13); disposal (r=.11); mixing/loading (r=.20); and spraying (r=.20). All of these correlations indicate that growers who reported a training influence in these behaviors would first approach their county agent for assistance. For example, of those growers who cited their county agents as their primary assistance source, 63% reported a change in the protective clothes they wear while mixing and loading and 44% reported a change in their spraying procedures as a result of training, while only 44% and 23% of those growers who consult their chemical dealers for assistance reported training impacts in mixing/loading and spraying behavior, respectively. For those behaviors where no correlation was found, growers did not tend to seek out one source of assistance with any more regularity than another.

3.4 Reported Behavioral Practices of Nonimpacted Respondents

Section 3.1 presented analyses of the various behavioral changes which were reported by growers in the New York survey. As discussed, the percentage of all growers that perceived changes in their behavior as a result of training varied depending on the specific reported behavior. The greatest impacts were in the areas of "protective clothing worn while mixing and loading" (45% of New York respondents perceived differences since training) while the behavioral area least changed was pest identification methods (20%).

This section discusses the reported behaviors, by individual behavioral areas, of those respondents who said that they had no differences in their pesticide-related behavior since training. This analysis is helpful because it examines whether or not respondents reporting "no differences since training" are doing nothing differently, because a behavior change was not necessary; i.e., their pretraining behaviors were already acceptable. For each "nonimpacted" respondent, information on reported current practices was obtained and is analyzed in the following paragraphs. Exhibit 3-7 summarizes the current behaviors of the New York respondents who reported no perceived differences in their behaviors since training.

Pesticide Transportation. Growers who reported no difference in their transportation methods since training were asked "How do you currently transport your pesticides?" Eighty-six percent of these nonimpacted growers reported using the bed of their truck, an encouraging percentage since this is the recommended procedure. Only 6% reported the unacceptable practice of carrying pesticides on their car seat or truck cab. The remaining 8% of respondents used their car trunk or a closed container (leak-proof and/or tied down), both considered to be acceptable practices. The relatively low impacts reported in this area in Section 3.1 are seemingly balanced by the fact that those reporting no impacts are generally exhibiting acceptable transportation practices.

Clothing Worn While Mixing or Loading. Sixty-eight percent of New York growers who reported no change in the protective clothing they wear while mixing and loading said they wear waterproof (or rubber) gloves for this activity. This compares closely with the entire five-state sample in which 64% of the nonimpacted respondents use waterproof gloves. For most articles of protective clothing, however, New York growers reported a greater incidence of use. For example, 26% of nonimpacted New Yorker growers report wearing rubber boots compared to only 12%

Exhibit 3-7

Reported Behavioral Practices of Nonimpacted Respondents

	New York (%)	Total (%)
1. **Methods of Pesticide Transportation**		
Bed of Truck	86	84
Trunk of Car	5	4
Truck cab/car seat	6	4
Other method (e.g., closed container)	3	2
2. **Clothing Worn When Mixing and Loading**		
Waterproof gloves	68	64
Waterproof boots	26	12
Long-sleeved shirt	18	25
Long trousers	10	16
Goggles or glasses	21	29
Respirator or filter mask*	34	17
Dust mask	29	22
Hat	25	15
Coveralls	28	22
Raincoat or rainsuit	26	10
Other clothing	5	4
None worn/necessary	10	12
3. **Clothing Worn While Spraying**		
Waterproof gloves	53	40
Waterproof boots	26	12
Long-sleeved shirt	20	27
Long trousers	13	19
Goggles or glasses	20	20
Respirator or filter mask	33	15
Dust mask	21	15
Hat	34	21
Coveralls	26	23
Raincoat or rainsuit	32	11
Other clothing	3	4
None worn/necessary	10	21
4. **Frequency of Calibration**		
Before each application	34	46
Before every other application	7	8
Before every 3 or 4 applications	18	13
Less often	31	22
Other (once a year)	10	6

*Includes charcoal cartridge, vapor, or nose mask.

Exhibit 3-7 (continued)

Reported Behavioral Practices of Nonimpacted Respondents

	New York (%)	Total (%)
5. **Methods of Drift Prevention**		
Spray when wind is low	82	80
Spray with wind direction	12	13
Spray during cooler times	6	4
Use lower pressure	4	10
Use larger nozzle opening	1	6
Use drift control agent	2	2
Spray closer to ground	10	11
Other method (e.g., not when raining)	18	18
No precaution taken/necessary	3	4
6. **Methods of Handling Leftovers**		
Drain it or bury it in ground	7	12
Leave it in applicator	4	4
Apply it to another field	3	5
Continue spraying until applicator empty	17	18
Dilute, then spray until applicator empty	3	2
Store in closed container	41	39
Don't have any leftover	21	18
Other methods (e.g., take to dealer)	12	12
7. **Methods of Pesticide Disposal**		
Burn them	35	37
Bury them	36	34
Rinse them	20	18
Crush or puncture them	9	14
Haul them to a landfill	28	22
Take them to a dump	13	15
Store them in a special place awaiting disposal	2	3
Other methods (e.g., take to dealer; re-use them)	7	8
8. **Methods of Pesticide and Equipment Storage**		
Keep them locked	18	14
Keep them in special area/shed/building	84	77
Keep them away from children/animals	6	10
Wash/clean before storing	28	24
Store away from extreme heat	6	7
Other methods (e.g., take to dealer)	5	8

of the nonimpacted growers in the survey; 34% of New York growers wear a respirator or filter mask compared with only half that percentage (17%) among the nonimpacted growers in the five-state sample. It is important to consider that while New York's nonimpacted growers wear more protective gear than growers in other states, New York also has a cooler spring climate than the other study states.

Clothing Worn While Spraying. Once again, the New York nonimpacted growers reported that they currently wear considerable amounts of protective clothing while spraying when compared to other states' nonimpacted growers. As shown in Exhibit 3-7, over half of nonimpacted New York growers wear waterproof gloves (53%); one-quarter wear waterproof boots (26%); one-third wear a rainsuit (32%); one third wear a respirator or filter mask (33%); one-quarter wear coveralls (26%); and one-third (34%) wear a hat. It is evident that both groups of New York respondents--those that reported a training influence on the clothes they wear as well as those that did not--tend to be conscientious in this area of personal safety and pesticide practice.

Equipment Calibration. As discussed in Section 3.1, a relatively small percentage of growers (22%) reported training impacts with respect to the frequency with which they calibrate their equipment. Almost one-third (31%) of the nonimpacted trainees reported calibrating their equipment less than every three or four applications, while another 18% said they calibrate about every three or four applications. One-third of the nonimpacted New York growers reported calibrating before every application. There are no standards for the number of times equipment should be calibrated, although the core manual encourages frequent rechecking of equipment to insure that the grower is spraying the same number of acres for each tankful applied. The manual also encourages the grower to stop spraying immediately and recalibrate if a periodic check suggests incorrect calibrations or changes in the sprayer delivery rate.

Methods of Drift Prevention. Eighty-two percent of the nonimpacted growers in New York reported that they spray when the wind is low, which is considered to be the single most important precaution to take while spraying. Other preventive measures employed include spraying by wind direction (12%) and spraying closer to the ground (10%). Responses in all five states indicate that growers are properly aware of the importance of drift prevention.

Handling Leftovers. When asked what they do with leftovers, 41% of nonimpacted New York trainees reported storing them in closed containers. This is acceptable if the type of container is sturdy and the seal secure. However, 17% of growers continue spraying the same field until their applicator is empty, a practice that can leave excessive residues if care is not taken to dilute the pesticide. (Only 3% of all unaffected growers reported diluting before spraying leftovers.) The most satisfactory possible response "no leftovers," was given by only one-fifth of the New York respondents. (It is possible that some respondents confused leftovers in the original pesticide container with leftovers in the sprayer tank.

Methods of Pesticide Disposal. Overall, the 64% of New York growers who reported that training did not affect the manner in which they dispose of their empty pesticide containers tend to use acceptable methods. As Exhibit 3-7 indicates, 71% either burn or bury their containers, 28% haul them to a landfill and 20% rinse them. A disturbing 13% reported the improper practice of taking them to a dump of unspecified supervision.

Methods of Pesticide Storage. The primary example of pesticide storage practices among nonimpacted New York respondents is "keep them in a special shed or building." Eighty-four percent of the growers who reported no differences since training in the way in which they store their pesticides and equipment said that their standard practice is to keep them in a special shed or building. Certainly, if such a shed or building is properly secured, then this practice is acceptable and the sizeable percentage is a promising figure. If, on the other hand, these storage areas are easily accessed by children or animals, or allow leakage, then a potential problem exists. Only 18% of the growers, in fact, reported storing their pesticides in a locked shed. Of the five states, New York had the highest percentage (28%) of growers who reported washing or cleaning their equipment before storage. Exhibit 3-7 displays, however, that overall the nonimpacted growers in all five states were very comparable in their pesticide equipment and pesticide storage behavior.

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EVALUATION OF THE PRIVATE APPLICATOR PESTICIDE TRAINING AND CERTIFICATION PROGRAM: A FIVE-STATE STUDY

APPENDIX F: Limited New York Pretest/Posttest Evaluation

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1.0 INTRODUCTION

Prior to the implementation of the full scale pretest-posttest evaluation design originally proposed by Abt Associates Inc. (AAI) in December 1979, the Office of Management and Budget (OMB) and representatives of the Environmental Protection Agency (EPA) requested that a "pilot test" be conducted to further assure participants of the merits of the pre-post evaluation design.[1] These self-administered questionnaires contained knowledge, attitude, behavior, and background questions. Half of the growers (randomly selected) at each training session would be given a knowledge pretest with an attitudes posttest, while the other half would take an attitudes and behavior pretest with a knowledge posttest. Knowledge and attitude effects would be tested by comparing the pretest scores of one half of the growers with the posttest scores of the other half.

Under the special pilot test, private applicators participating in initial certification training in the state of New York during 1980 were to receive questionnaires immediately before and after training. Most training sessions in New York had been completed by the time the pilot study questionnaire was approved, except for a limited subset at the end of the training session. It is this subset of private applicators in New York on which this report is based.

Completed questionnaires were obtained on 102 New York growers at the last four training sessions for the year, held during late March and early April 1980. Each of the three to four hour training sessions were in the evening, and the participants were asked to spend an extra 20 minutes before and after training to complete the questionnaires. The training materials used in the sessions, and on which the questionnaires were largely based, included the Northeast Core Manual, a 22-minute film, and a 79-frame slide/tape series. The posttest administered following training incorporated knowledge questions from the New York certification examination; so, the posttest for this subset of growers were also scored for certification purposes.

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[1] For a more comprehensive description of the study design and background, consult Chapter 1.0.

The questionnaires used in the pilot test are included as an appendix to this report. The four categories of questions contained in the instruments are summarized below:

KNOWLEDGE (37 Questions)

- Pest Identification and Control
- General Pesticide Information
- Pesticide Labels and Labeling
- Pesticide Hazards and Safety Precautions
- Pesticide Application and Equipment Calibration
- Pesticide Laws and Regulations

BEHAVIOR (20 Questions)

- Frequency of Pesticide Use
- Methods of Transporting
- Methods of Mixing/Loading
- Methods of Applying
- Methods of Storing
- Methods of Disposing

ATTITUDES (18 Questions)

- Environmental Protection versus Agricultural Production
- Pesticide Hazards and Safety Precautions
- Pesticide Laws and Regulations
- Sources of Pesticide Information
- The Training and Certification Program

BACKGROUND (6 Questions)

- Farm Size
- Principal Crops
- Education
- Age
- Distance from Nearest City
- Years of Pesticide Experience

Individual survey questions were developed jointly by Abt Associates staff, Abt Associates project consultants, EPA staff, and the state advisory panels assembled for the study. Several of the questions were drawn from a previous study in North Carolina conducted for EPA by the Educational Testing Service and from a national study of environmental attitudes conducted by Resources for the Future.

The basic design for administering the survey questions at each training session is shown below:

Group A (Yellow form) R O_{BA} X O_{KI}

Group B (Green form) R O_{KI} X $O_{A\ 1/2K}$

where
R represents randomization
O represents survey administration
X represents training administration
K represents knowledge questions
A represents attitude questions
B represents behavior questions
I represents background questions

With this design we are confident that any pretest-posttest effects observed may be attributed to training (i.e., high internal validity); however, several limitations of the study pertaining to the generalizability of the results to the New York private applicator population (i.e., the external validity of the study) should be noted. First of all, private applicators trained in 1980 were likely to consist of less experienced (with pesticides) or more recalcitrant (to training) growers than those trained in prior years and may respond to training differently. Secondly, of the approximately 400 private applicators trained in New York in 1980, a nonrandom (chronologically last) quarter of these were included in this study (from Madison, Monroe, Oneida, and Genesee counties). Therefore, the reader should keep in mind that the analyses contained in this report are of a limited sample of growers and the suggested findings should not be indiscriminately generalized to New York State as a whole. In addition, a larger sample size might have resulted in additional significant study findings. Lastly, we have made no attempt to control any social-desirability bias inherent in the interpretation of the "correct" answer to knowledge, attitude, or behavioral responses; the analysis reflects the responses considered desirable by the standards set in the New York Pesticide Applicator Training Program.

The remainder of this report describes the pilot test results for each of the four sets of survey questions.

2.0 MAJOR FINDINGS

The New York pretest-posttest evaluation, albeit limited in scope, yields some interesting findings. These results are suggestive of both areas in which the training program appears to have had the greatest impact on the trainees and areas in which the training program might have the greatest impact. This latter area of potential impact may be most useful for future targeting of training material on those topics where the growers appear to be less knowledgeable or where growers are reporting pretraining behavior which is less desirable than the recommended actions vis-a-vis the application and disposal of pesticides.

The following highlights some of the major and more interesting results of the background, attitude, behavior, and knowledge portions of the questionnaire. Each of the remaining sections of this brief report address the specific findings within each of these areas.

BACKGROUND (See Section 3.0)

- About half of the sample had less than two years of experience using pesticides and about half had at least two years of experience; about 15% of the sample reported having experience with pesticides for over 10 years.
- With regard to size of farm, about half of the sample farmed over 200 acres and half farmed under 200 acres.
- The sample contained a broad distribution with respect to age, although about 67% were 20-34 years old.
- The types of principal crops grown were varied and no particular crop was overrepresented in any single category.
- The sample was generally educated; 84% had high school diplomas and 25% reported graduating from college.

The background characteristics of both the pretest and posttest groups were compared to determine if any significant differences existed which would affect subsequent analyses of the data with respect to the attitude/knowledge questions. No significant differences were found, enabling us to aggregate the groups for these analyses.

KNOWLEDGE (See Section 4.0)

- Given that the State of New York Department of Environmental Conservation (DEC) requires a score of 70 or better on a certification examination before certifying a private applicator, the pretest-posttest scores indicate that a majority of the respondents (60%) failed the pretest, while most of the respondents (67%) passed the posttest.
- Mean scores showed significant gain from pretest to posttest in the categories called "General" Information About Pesticides," "Labels and Labeling," and "Application and Calibration," in that order.
- The magnitudes of change by knowledge category appear to mirror the proportionate amount of time devoted to each respective category during training, with the exception of "Pesticide Hazards and Safety Precautions," which registered less change than expected given its emphasis in training.
- There is a strong positive relationship between education level and obtaining higher knowledge scores, as is there a tendency for growers with more years of pesticide experience to score higher on the pretest; however, in terms of degree of change the less educated growers learned more from the training than the more educated growers.
- There was no association found between a respondent's pretest or posttest score and size of farm, age, or distance from the nearest city.

Despite the small size of the sample it can be stated with 95% confidence that the sample respondents showed a significant increase in their pesticide-related knowledge as a result of the New York private applicator training program.

ATTITUDES (See Section 5.0)

- The growers' positive assessments about how worthwhile the training was became even more positive following training, and this appeared especially true for the small-scale grower (less than 100 acres) and the less educated and older grower.

- No association was found between years of pesticide experience and an assessment of the training worth.

- The training significantly reinforced the growers' awareness that there are pesticides being sold and used that are hazardous when improperly applied.

- The greatest difference in attitudes from the pretest to the posttest was registered with respect to the statement "Experienced pesticide users do not really need the certified applicator program." The training appears to have significantly reinforced the notion that information about pesticides and pesticide use was helpful even to the experienced pesticide user.

- Significant shifts were observed with regard to more accepting attitudes toward the need for laws and regulations controlling pesticide use; the role of government in controlling pesticide use; and the merits (versus the inconvenience) of the certified applicator program to the growers.

In general, the training appears to reinforce pretraining positive attitudes on the part of the growers toward both the training program and the need for pesticide safety awareness, and the training appears to help neutralize some of the stronger negative attitudes prior to training.

BEHAVIOR (See Section 6.0)

- Growers indicated that prior to training the vast majority were already carrying pesticides safely in the bed of the truck or in the trunk of the car.

- Prior to training, only 40% of the growers reported locking up stored pesticides.

- The pesticide disposal techniques reported by the growers were varied and possibly of questionable safety; most either apply the leftover pesticide to another field or dilute the leftover and apply again to the same field. Only two respondents indicated that they did not have to deal with leftover pesticides, which may indicate the best recommended method, i.e., preventing pesticide surplus. Seven respondents (15% of Group A) reported draining leftover pesticides directly on the ground.

Because the behavior portion of the questionnaire was taken prior to training, the results are particularly helpful in identifying behaviors which are dangerous or potentially harmful and upon which training may have its greatest impact. For example, the varied and questionable handling of leftover pesticides appears to be more problematic among pesticide users than the transporting of chemicals from the distributor to the farm; this suggests possible areas of emphasis for subsequent training programs.

In the following sections, the specific findings with respect to the background, knowledge, attitude, and behavior questions are each addressed separately.

3.0 BACKGROUND QUESTIONS

The following section describes the sample of individuals who completed the New York pilot test. Basic descriptive statistics of the group as a whole are provided along with some comparisons between the pre- and posttest groups. Since no significant differences between the two groups were found, the analysis is based on the aggregate, unless otherwise indicated.

There were 102 individuals who participated in the New York pilot test, with 53 respondents taking the pretest and 49 completing the posttest questionnaire. The majority of the sample participants had a least two years of experience in using pesticides (55.8%). However, the group also contained 43 people (42.2%) who had less than two years of experience, and 17 people (16.7%) who had over ten years of experience. Table 3-1 profiles the groups' years of experience with pesticides.

A wide distribution of ages was represented by the group, with the majority (66.7%) in the 20-34 age range. None of the growers reported being more than 64 years old and only 5.9% were under 20 years old. The educational background of over 84% of the group included a high school degree, with nearly 25% of the sample having graduated from college. Only 13.7% of the sample had not graduated from high school.

The group was equally divided between growers who farm less than 200 acres (44.2%) and those who farm more than 200 acres (44.1%). Among the smaller growers, the majority farmed lots less than 25 acres. In both the pre- and posttest groups, the vast majority of growers lived within 50 miles of a city with a population of 30,000 or more (93.1% of the total group).

When asked to name all the "principal crops" they grow, 80.4% of the sample indicated growing between one to four primary crops. The most commonly grown crop was corn (67%), including both sweet and field corn, in that order. Hay was the second largest crop (34%). The 9.8% of alfalfa growers did not specify whether they used their crop for hay or forage. However, if alfalfa is added to the hay crop, hay would remain the second largest category at 43.8%. Vegetable and fruit growers were the next largest categories (29.4% and 26.8% respectively). Among the vegetable growers, cabbage was most frequently specified; among fruit growers, apples were the most common. Oats and wheat were the next most frequently grown crops (9.8% and 5.9% respectively). The "other" category totalled 8.8% of the respondents and included individuals who listed turf, flowers (marigolds and ageratum), trees and shrubs, aquatics (sic), and unspecified cash crops and forages. Table 3-2 summarizes the principal crops grown by the sample respondents.

Table 3-1
Number of Years Experience in Using Pesticides

	Pretest	Posttest	Total
< 2 years	39.6%	44.9%	42.2%
2- 4 years	20.8%	18.4%	19.6%
5-10 years	22.6%	16.3%	19.6%
11-20 years	17.0%	8.2%	12.7%
21+ years	0%	8.2%	3.9%
No Answer	--	4.1%	2.0%

Table 3-2
Percentage of Principal Crops Grown [1]

	Pre-Test	Posttest	Total
Corn	74.4%	59.0%	67.0%
Hay	30.2%	38.5%	34.0%
Vegetables[2]	46.5%	25.6%	29.4%
Fruits[3]	14.0%	41.0%	26.8%
Oats	11.6%	12.5%	9.8%
Alfalfa	16.3%	7.7%	9.8%
Wheat	7.7%	7.0%	5.9%
Other[4]	3.9%	4.9%	8.8%

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[1] Percentages total more than one hundred percent due to multiple responses.

[2] Responses included: squash, potatoes, cabbage, peas, beans, peppers, soybeans, pumpkins, general vegetables.

[3] Responses included: fruit, apples, cherries, peaches, melons, grapes, strawberries, small fruit

[4] Responses included: forages, pasture, turf, trees and shrubs, flowers, aquatics, cash crops.

4.0 KNOWLEDGE QUESTIONS

In order to test for changes in pesticide knowledge due to training, a 37-item multiple choice knowledge test was developed carefully which addressed the following training-related topics:

• Pesticide identification and control	(5 questions)
• General pesticide information	(4 questions)
• Pesticide labels and labeling	(6 questions)
• Hazards and safety precautions	(9 questions)
• Application and equipment calibration	(5 questions)
• Pesticide laws and regulations	(8 questions)

The number of questions to be included within each category and the specific wording of each question and possible answers were determined jointly by Abt Associates staff and consultants, EPA staff, and the numerous state advisory panels.[1] Many of the questions were drawn (and often modified) from instruments developed and administered for EPA in North Carolina by the Educational Testing Service. To avoid confusing training effects with effects due to pretesting, pretest scores for a random half of the growers at each session are compared in this analysis with posttest scores for the other growers (who did not take a knowledge pretest).

Table 4-1 displays the results of the knowledge questions for the 101 trainees in New York who completed the pretest (N = 48) or the posttest (N = 53). The mean score on the pretest was 63 indicating that the average pretest respondent answered 23 of the 37 questions correctly (63%). The mean posttest score increased significantly ($t = 3.32$ $p < .001$) to 72 reflecting an average of 27 correct answers. Given that the State of New York Department of Environmental Conservation (DEC) requires a score of 70 or better on such a test before certifying a private applicator, an important observation to be made is that (excluding the True/False exam section added by DEC) a majority (60%) of the pretest respondents failed the test while most (67%) of the posttest respondents passed the test.

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[1] It should also be noted that the posttest questionnaire included an additional true/false section to permit the posttest to be simultaneously used for study purposes and as the New York State certification exam.

The percentage of respondents answering each knowledge question correctly increased from pretest to posttest for four out of every five questions. One out of every three of these percentage gains was statistically significant at the .05 level or better. Table 4-1 also shows the changes in mean scores from pretest to posttest for the six categories of pesticide information. The category called "General Information About Pesticides" showed the greatest overall gain in mean item scores (20 points) followed by "Labels and Labeling" (12 points) and "Application and Calibration" (11 points).

The magnitudes of change by category appear to mirror the proportionate amount of time devoted to each respective category during training, with the exception of "Pesticide Hazards and Safety Precautions" which registered less change (5 points) than expected given its emphasis in training. Since pretest scores for this category were higher than for any other category, the small magnitude of change is less problematic.

Looking at pretest knowledge scores in relation to the background of the respondent, we find a fairly strong positive relationship between education level and knowledge scores (r = .46).[1] There is also a tendency for growers with more years of pesticide experience to score high on the pretest (r = .26). No association was found between a respondent's pretest score and his or her size of farm, age, or distance from the nearest city. In the case of posttest knowledge scores, the same association (r = .26) was found between years of pesticide experience and test scores, and once again no association was found between test scores and farm size, age, or location. The tendency for better educated growers to score higher on the knowledge test diminished, however, from r = .46 on the pretest to r = .26 on the posttest, suggesting that the less educated growers learned more from training than the more educated growers.

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[1] With a sample size of 50, the magnitude of positive or negative association required to be statistically significant at the .05 level is .27 or greater.

In summary, despite being handicapped by a small sample size, we can state with 95% confidence that, in 1980, training in these four counties of New York State effected a significant increase in the pesticide-related knowledge of private applicator program participants. This increase was concentrated in the areas of "General Pesticide Information," "Labels and Labeling," and "Application and Calibration," and it appears to have been greater for less educated growers than for more educated growers.

5.0 ATTITUDE QUESTIONS

The attitudes of program particpants toward the training program and toward the need for pesticide safety were measured before training for one half of the growers and after training for the other half. Figure 5-1 displays the responses of both groups to 14 agree-disagree type attitude statements.

In general, grower attitudes toward the program and toward the hazards of using pesticides were positive before training and significantly more positive after training. For example, 68% of the pre-training respondents strongly agreed with the statement that "there are many pesticides now being sold to farmers that are hazardous when improperly applied," compared to 92% of the post-training respondents. The pre-post difference in level of grower agreement with this item is statistically significant at the .01 level.

Other statements to which a majority of respondents also strongly agreed (but which did not register statistically significant changes in response to training) are listed below:

Attitude Item	Percent Who Strongly Agreed	
	Pretest	Posttest
d. Protective clothing is necessary even when the pesticide label does not have a skull and crossbones symbol.	52%	53%
i. The certified applicator program makes farmers aware of the dangers of using pesticides.	60%	73%
k. The certified applicator program teaches farmers the correct use of pesticides.	46%	59%

Several of the attitude statements produced significant shifts in level of disagreement from before to after training. The statement which produced the greatest difference (p<.01) between the pretest and posttest groups of all 14 items was that "experienced pesticide users do not really need the certified applicator program." The percentage of respondents who strongly disagreed with this statement more than doubled from 28% of the pretest group to 57% of the posttest group.

Other statistically significant shifts in disagreement occurred in response to the three statements below:

	Attitude Item	Percent Who Strongly Disagreed Pretest (N=50)	 Posttest (N = 49)
f.	There are too many laws and regulations in effect for controlling the use of pesticides by farmers.	12%	37%
j.	The certified applicator program is an inconvenience to farmers.	16%	39%
l.	The certified applicator program involves too much government interference.	12%	37%

The only statement which showed a significant (p<.05) pre-post change in an unexpected direction was that "the certified applicator program provides an opportunity for farmers to discuss pest control problems with their county agent." Significantly fewer of the posttest respondents agreed with this statement than the pretest respondents, although most growers in both groups did agree (either somewhat or strongly) with this statement.

The private applicator training participants were also asked how worthwhile they "expected" (pretest wording) or "found" (posttest wording) the training session to be. The percentage of growers who responded "very worthwhile" to this question rose significantly ($p<.01$) from 52% of pretest respondents to 65% of posttest respondents. Overall, 92% of the pretest group expected the training to be at least somewhat worthwhile.

For the posttest group, the overall assessment of training was examined in relation to the background of the respondent. Size of farm was found to be inversely related to training assessment ($r = -.28$), with large-scale growers tending to evaluate the program as less worthwhile than small-scale growers. Less educated and older respondents showed a slight tendency to rate the training as being more worthwhile than the better educated and younger respondents ($r = -.19$ and $r = .22$, respectively). Program participants living the farthest away from a city of 30,000 persons or more tended to rate the training more favorably ($r = .26$) than those living close to or in such a city. No association was found, somewhat surprisingly, between years of pesticide experience and assessment of training worth ($r = -.05$).

An attempt was also made in this pilot test to determine whether the private applicators felt that too many or too few pesticides were restricted in the State of New York. Three out of every four respondents answered "Don't Know" when asked if there were any pesticides currently restricted which they felt should not be, and similarly when asked about pesticides not restricted which should be. For this reason, no useful information was obtained from these questions (other than the fact that 6% of the applicators surveyed felt that the pesticide Endrin should not be restricted.)

It appears from this limited pilot test that participation in training serves to reinforce the already favorable attitudes of the growers toward both the program itself and the need for pesticide safety awareness. There was a high level of agreement among respondents that the training program makes farmers aware of the dangers of using pesticides, teaches them the correct use of pesticides, and is worthwhile even for experienced pesticide users.

6.0 BEHAVIOR QUESTIONS

As part of the New York pilot test a series of behavioral questions were asked to determine how the growers used pesticides prior to receiving the state's applicator training course. No posttest questions on behavior were asked since the posttest questionnaire was administered immediately after the training.

Respondents to whom the behavior questions were administered included 53 individuals, the majority of whom (57.2%) farmed 100 or more acres of land. Another quarter of this pretest group (26.5%) farmed lots of less than 25 acres. While nearly half of the group (44.9%) had less than two years' experience using pesticides, 32.7% had five years or more experience and 16.4% had ten years of more of experience in using pesticides.

When asked how often they had applied pesticides in the past three years, 45.3% checked "a few times a year" with the second largest response group being "many times a year" (24.5%). Only 15.1% indicated that they had applied pesticides "about once a year" and an additional eight respondents who had never applied pesticides in this time period did not complete the rest of the behavior questions.

The primary use of pesticides was about equally split between control of insects (44.4%) and control of weeds (46.7%). Only two respondents (4.4%) were mostly concerned with plant diseases and an additional two respondents (4.4%) applied pesticides equally for both insects and weeds.

When asked to approximate the amount of money they spent last year on insecticides, fungicides, herbicides and other pesticides, 75.6% (34 respondents) supplied estimates. Ten respondents (22.2%) did not answer and one individual (2.2%) did not know the amount. Of the responses to this question, 44.1% spent less than $1000, 35.3% spent between $1000 and $5000 dollars, 5.9% spent more than $5000, and 14.7% said they spent nothing.

Growers were asked several questions about their handling of pesticides both before and after application. The vast majority of the group (88.9%) reported that they carried pesticides in the bed of their truck or trunk of their car. Only two individuals said they carried a pesticide in the cab of their truck.

Growers also were asked what measures they took to ensure that other people were protected from stored pesticides. Most respondents utilized more than one approach to safeguarding stored pesticides. The most frequently used techniques were to "keep them out of reach of children" (82.2%) and to "keep them away from high traffic areas" (71.1%). A relatively low 40% of the respondents stated that they kept pesticides locked up. Another 15.6% of the responses specified other approaches including posting signs, keeping them out of sight, maintaining good ventilation in the storage area, keeping them in a special area, and only storing unopened cans.

Two additional questions addressed safety precautions taken after the application of pesticides. Growers were asked to indicate all of the things they did with leftover pesticide when their job was finished. Table 6-1 displays the responses to this question. Two techniques garnered the largest number of responses: 37.8% would apply the leftover pesticide to another field and 28.9% would dilute it and then respray the same field to use up the remaining amount. The 11.1% who specified other approaches included two respondents who said they have not yet had to deal with the problem. One person indicated that he would reapply to problem areas and another stored the leftover pesticide and then diluted and drained the residue in the applicator. Disposal of empty pesticide containers was reported by a majority of respondents to be handled in an acceptable fashion. Most of the growers took steps to insure that pesticide containers would not be reused.

Table 6-1
Handling of Leftover Pesticide After Application

	No. of Responses	Percent[1]
Apply it to another field	17	37.8
Dilute the pesticide, then spray the same field until applicator is empty	13	28.9
Drain it onto the ground	7	15.6
Continue applying it to the same field until applicator is empty	6	13.3
Leave it in the applicator	5	11.1
Other	5	11.1

Table 6-2
Information Sources for Pesticide Application

	No. of Responses	Percent[1]
Label on the container	40	88.9
Dealer's recommendation	15	33.3
Personal knowledge/experience	15	33.3
USDA and Extension Service Guidebooks	8	15.5
County agent's recommendation	5	11.1
Farm magazines, radio, TV	2	4.4
Vocational agriculture teacher	1	2.2
Neighbor's recommendation	1	2.2
Other	6	13.3

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[1] Percentages exceed 100% due to multiple responses.

Questions about the actual application of pesticides probed how the growers determined how much to use, how often they calibrated their equipment and what techniques they used to control spray drift. By far the largest number of growers (88.9%) indicated that they relied on the label on the container to decide how much of a pesticide to use. The next most frequently used sources of information were a dealer's recommendation and personal knowledge or experience, both indicated by 33.3% of the growers. Table 6-2 displays responses to this question. The six growers who listed "other" included two who relied on the Agway Chemical Book, one who participated in experimental research, and three who took instruction from their boss or father.

Most growers seem to stick to applying the label's recommended amount of pesticide, as indicated by questions about whether they sometimes decided to use more or less than the recommended amount of . pesticide. Approximately 15.5% of the growers said they sometimes used more than the recommended amount of pesticide. The seven who used more said it was because either the problem was worse than usual or the recommended amount was not effective enough for the pest problem. Growers were nearly evenly split on choosing to use less than the recommended amount, with 46.7% saying that they sometimes did and 53.3% saying that they did not. Of the twenty-one respondents who sometimes use less, the primary reason was because the pest problem was not severe.

Growers split fairly evenly on how often they calibrate their applicator equipment. The largest number (33.3%) said that they calibrate after more than every sixth application; 24.4% calibrated before each application; 20.0% after every two or three; and 17.8% after every four to six applications. When asked what they did to control spray drift, the group responded with the practical approach -- 95.6% waited for the wind to die down.

In summary, it appears that the pre-training behavior of the growers with respect to certain behavior like transporting pesticides in the back of a truck or trunk of a car would be least effected by training since the behavior was already consistent with the recommended method prior to training. With respect to the handing of leftover pesticides, however, the varied and questionable pre-training behaviors reported may suggest an area in need of emphasis during training and is an example of a behavior that may be subject to significant change as a result of training.

ABT ASSOCIATES INC.
55 WHEELER STREET
CAMBRIDGE, MA 02138

MARCH 1980
OMB NO: 116-S-79028
APPROVAL EXPIRES: 9/30/80

PESTICIDE APPLICATOR STUDY
PRE-TRAINING QUESTIONNAIRE

THIS PACKET INCLUDES: 1) A questionnaire, not to be graded and 2) your certification exam which is sealed. The purpose of the questionnaire is to help us evaluate the Environmental Protection Agency (E.P.A.) and the Department of Environmental Conservation (D.E.C.) Pesticide Application Certification Program. This Certification Program was designed to help insure the safe and proper use of pesticides. Now we are trying to see how effective it has been.

Abt Associates Inc., an independent research firm, is conducting the survey, and it is being done with the cooperation of D.E.C. and the Extension Service. While your own cooperation is voluntary, your participation is important to the success of this study. Your responses to the questions in the questionnaire HAVE ABSOLUTELY NOTHING TO DO WITH YOUR CERTIFICATION--CERTIFICATION IS DETERMINED ONLY BY YOUR STATE CERTIFICATION EXAM. The questions will not be individually graded. There is no such thing as "failing" on this questionnaire. No one other than Abt Associates staff will be allowed to see your responses to the questionnaire--not even your county agent or regional inspector.

Thank you, in advance, for your help in making this effort possible. It is through this type of evaluation that we ensure the effectiveness of our program.

COUNTY NO: ______________

NEW YORK
FORM A

GROWER NO: ______________

SECTION II

CARD 3
11-12/02

1. How strongly do you agree or disagree with each of the following opinion statements? (CIRCLE ONE ANSWER CODE TO THE RIGHT OF EACH ITEM.)

		Strongly Agree	Agree Somewhat	Neither Agree Nor Disagree	Disagree Somewhat	Strongly Disagree	
a.	There are many pesticides now being sold to farmers that are hazardous when improperly applied.	1	2	3	4	5	13/
b.	The government is spending too much money to protect the environment from potentially harmful pesticides.	1	2	3	4	5	14/
c.	Environmental damage from pesticides is less serious then crop damage from pests	1	2	3	4	5	15/
d.	Protective clothing is necessary even when the pesticide label does not have a skull and crossbones symbol.	1	2	3	4	5	16/
e.	It is more important to protect the environment than to grow as big a crop as possible.	1	2	3	4	5	17/
f.	There are too many laws and regulations in effect for controlling the use of pesticides by farmers	1	2	3	4	5	18/
g.	Experienced pesticide users do not really need the certified applicator program.	1	2	3	4	5	19/

1. (Continued)

		Strongly Agree	Agree Somewhat	Neither Agree Nor Disagree	Disagree Somewhat	Strongly Disagree	
h.	Most farmers were using pesticides correctly before the certified applicator program started.	1	2	3	4	5	20/
i.	The certified applicator program makes farmers aware of the dangers of using pesticides.	1	2	3	4	5	21/
j.	The certified applicator program is an inconvenience to farmers.	1	2	3	4	5	22/
k.	The certified applicator program teaches farmers the correct use of pesticides.	1	2	3	4	5	23/
l.	The certified applicator program involves too much government interference.	1	2	3	4	5	24/
m.	The certified applicator program provides an opportunity for farmers to discuss pest control problems with their county agent.	1	2	3	4	5	25/
n.	After completing the certified applicator program, using pesticides in accordance with State and Federal laws will be no problem.	1	2	3	4	5	26/

2. Below are some ways you might find out about which pesticides to use and how to use them. (INDICATE HOW MUCH YOU WOULD BELIEVE INFORMATION YOU GOT IN EACH WAY BY CIRCLING ONE ANSWER CODE TO THE RIGHT OF EACH ITEM.)

	Would Usually Believe	Would Sometimes Believe	Would Usually Not Believe	
a. A chemical company salesman	1	2	3	27/
b. An agricultural chemicals dealer. . . .	1	2	3	28/
c. A county extension agent.	1	2	3	29/
d. Another grower.	1	2	3	30/
e. The label on the pesticide container. .	1	2	3	31/
f. USDA and Extension Sevice guidebooks. .	1	2	3	32/
g. Articles in farm magazines.	1	2	3	33/
h. Advertisements for pesticides	1	2	3	34/
i. A USDA official	1	2	3	35/
j. An EPA official	1	2	3	36/

3a. Are there any pesticides currently restricted in your state which you feel should not be restricted? (CIRCLE ONE ANSWER CODE.)

Yes	1	37/
No	2	
Don't know	8	

(SKIP TO Q.4a) ←

3b. (IF YES) Which one(s) in particular (WRITE IN YOUR ANSWER BELOW.)

____ 38-39/

____ 40-41/

____ 42-43/

4a. Are there any pesticides not currently restricted in your state which you feel should be restricted? (CIRCLE ONE ANSWER CODE.)

Yes 1 44/

No 2
(SKIP TO Q.5) ←

Don't know 8
(SKIP TO Q.5) ←

4b. (IF YES) Which one(s) in particular? (WRITE IN YOUR ANSWERS BELOW.)

____ 45-46/

____ 47-48/

____ 49-50/

5. Overall how worthwhile to you do you expect the Pesticide Applicator Training and Certification Program to be? (CIRCLE ONE ANSWER CODE.)

Very Worthwhile 1 51/

Somewhat Worthwhile . . . 2

Not too Worthwhile . . . 3

Not at all Worthwhile . . 4

SECTION III:

1. About how many acres of land do you farm? (INCLUDE ALL LAND RENTED OR OWNED. CIRCLE ONE ANSWER CODE.)

Less than 25 acres	1	61/
25 - 49 acres	2	
50 - 99 acres	3	
100 - 199 acres	4	
200 acres or more.	5	

2. What are your principal crops? 1.____________________________ 62-63/

(LIST MOST IMPORTANT FIRST) 2.____________________________ 64-65/

3. What was the last year of school that you completed? (CIRCLE ONE ANSWER CODE.)

Less than 8th grade	1	66/
8th to 11th grade	2	
High school graduate	3	
Some college or technical school	4	
College graduate	5	

4. What is your age? (CIRCLE ONE ANSWER CODE.)

19 or less	1	67/
20 - 24	2	
25 - 34	3	
35 - 44	4	
45 - 54	5	
55 - 64	6	
65 or more	7	

5. How far do you live from the nearest city with a population of 30,000 or more? (CIRCLE ONE ANSWER CODE.)

Less than 25 miles	1	68/
Between 25 and 49 miles	2	
Between 50 and 99 miles	3	
Between 100 and 199 miles	4	
200 miles or more	5	
Don't know	8	

6. How many years of experience do you have in using pesticides? (CIRCLE ONE ANSWER CODE.)

Less than 2 years	1	69/
2 - 4 years	2	
5 - 10 years	3	
11- 20 years	4	
21 years or more	5	

STOP! DO NOT OPEN THE NEXT QUESTIONNAIRE UNTIL YOU ARE INSTRUCTED TO DO SO.

ABT ASSOCIATES INC.
55 WHEELER STREET
CAMBRIDGE, MA 02138

MARCH 1980
OMB NO: 116-S-79028
APPROVAL EXPIRES: 9/30/80

PESTICIDE APPLICATOR STUDY
PRE-TRAINING QUESTIONNAIRE

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Abt Associates Inc., an independent research firm, is conducting the survey, and it is being done with the cooperation of D.E.C. and the Extension Service. While your own cooperation is voluntary, your participation is important to the success of this study. Your responses to the questions in the questionnaire HAVE ABSOLUTELY NOTHING TO DO WITH YOUR CERTIFICATION--CERTIFICATION IS DETERMINED ONLY BY YOUR STATE CERTIFICATION EXAM. The questions will not be individually graded. There is no such thing as "failing" on this questionnaire. No one other than Abt Associates staff will be allowed to see your responses to the questionnaire--not even your county agent or regional inspector.

Thank you, in advance, for your help in making this effort possible. It is through this type of evaluation that we ensure the effectiveness of our program.

COUNTY NO: ______________

NEW YORK
FORM B

GROWER NO: ______________

SECTION I

CARD 1
11-12/01

IN THIS SECTION, CIRCLE THE ONE ANSWER CODE FOR EACH ITEM THAT YOU THINK BEST ANSWERS THE QUESTION ASKED.

1. Which of the following things cause plant diseases that cannot spread from one plant to another?

Air pollutants 1 13/
Fungi 2
Viruses 3
Nematodes 4

2. If a weed is a summer annual, its seeds sprout in the

Winter 1 14/
Spring 2
Summer 3
Fall 4

3. The best way to tell one adult insect type from another is to look at the mouth parts and 15/

Wings 1
Antennae 2
Eyes 3
Legs 4

4. Which of the following is a vertebrate pest?

A snail 1 16/
A nematode 2
A rat 3
A termite 4

IN THIS SECTION, CIRCLE THE ONE ANSWER CODE FOR EACH ITEM THAT YOU THINK BEST ANSWERS THE QUESTION ASKED.

5. To control plant damage caused by insects, you should start using an insecticide when the pest

Is first identified	1	17/
First begins to spread	2	
Has destroyed 5% of the crop	3	
Has caused an unreasonable amount of damage	4	

6. The term that describes an herbicide that is applied after the weeds are growing is

Preemergence	1	18/
Preplant	2	
Postplant	3	
Postemergence	4	

7. The proper use of a plant-growth regulator can

Prevent nematode damage	1	19/
Prevent potato sprouting	2	
Control plant disease	3	
Control rodents	4	

8. If a pesticide is absorbed in one part of a plant or animal and gets transported to another part where it kills a pest, it is called a

Contact pesticide	1	20/
Translocated pesticide	2	
Systemic pesticide	3	
Nonselective pesticide	4	

IN THIS SECTION, CIRCLE THE ONE ANSWER CODE FOR EACH ITEM THAT YOU THINK BEST ANSWERS THE QUESTION ASKED.

9. Which of the following pesticide formulations should normally be mixed with water before application?

Ultra-low volume solutions (ULV) . . 1 21/
Granules (G) 2
Flowables (F) 3
Dusts (D) 4

10. The term "directed application" on the label of a pesticide means that the pesticide should be

Used on certain insects only 1 22/
Applied only at certain times of the day 2
Aimed at a portion of a plant, animal, or building . . . 3
Applied directly without dilution 4

11. The section of a pesticide label that tells what pest the product will control is the

Directions for use 1 23/
Statement of use classification . . . 2
Symbol and signal word 3
Statement of practical treatment . . 4

12. The "re-entry statement" on a pesticide label tells you how long to wait before

Working in a treated area without protective clothing 1 24/
Harvesting a crop from the treated area 2
Retreating the area with the same pesticide 3
Retreating the area with a different pesticide 4

IN THIS SECTION, CIRCLE THE ONE ANSWER CODE FOR EACH ITEM THAT YOU THINK BEST ANSWERS THE QUESTION ASKED.

13. Which label warning indicates the lowest toxicity hazard to humans?

"WARNING" 1 25/
"CAUTION" 2
"Keep Out of Reach of Children" . . . 3
"DANGER" 4

14. In the event of accidental personal injury with a pesticide, the most important part of the label to look for is the

Misuse statement 1 26/
Physical and chemical hazards . . . 2
Directions for use 3
Statement of practical treatment . . 4

15. Which of the following statements on a pesticide label is an example of an environmental hazard?

Poisonous by swallowing or inhalation 1 27/
Keep out of any body of water 2
Avoid contamination of food and feed stuffs 3
Do not use near heat or an open flame 4

16. Of the following, which is the safest way to transport containers of a liquid pesticide?

In the back of a truck, fastened so they will not move 1 28/
In the driver's compartment, where they may be easily watched. 2
In the trunk of a car, where they will be protected from the weather 3
In the back of a truck, surrounded by bales of hay 4

IN THIS SECTION, CIRCLE ONE ANSWER CODE FOR EACH ITEM THAT YOU THINK BEST ANSWERS THE QUESTION ASKED.

17. What is the best thing to do if a strong wind comes up while you are spraying a highly toxic pesticide?

Put on extra protective clothing 1 29/

Drive your sprayer faster. 2

Reduce the pressure and drive slower . . . 3

Stop spraying until the wind dies down . . 4

18. With boom sprayers, spray drift from the application of a pesticide can best be controlled by use of

High pressure and a small nozzle opening 1 30/

Low pressure and a large nozzle opening 2

High pressure and a large nozzle opening 3

Low pressure and a small nozzle opening 4

19. What is the first thing you should do if you inhale a pesticide while working in an enclosed space?

Get to fresh air right away 1 31/

Read and follow the first aid directions on the label 2

Tell somebody what happened 3

Call your doctor for advice 4

20. When mixing a liquid pesticide in a sprayer tank, generally how much water should you put into the tank before pouring in the pesticide?

None 1 32/

Enough to cover the bottom of the tank . . 2

About 1/3 of the tank 3

Nearly a full tank 4

IN THIS SECTION, CIRCLE THE ONE ANSWER CODE FOR EACH ITEM THAT YOU THINK BEST ANSWERS THE QUESTION ASKED.

21. What is the first thing to do if you spill a pesticide on your hands?

Wipe it off with a towel 1 33/

Rinse it off with plenty of water 2

Wash your hands with warm water 3

Wash your hands with a detergent and water 4

22. What is the first thing you should do if you splash a pesticide into your mouth?

Go or be taken to a doctor 1 34/

Induce vomiting 2

Take the antidote listed on the label . . 3

Rinse your mouth with water. 4

23. The term "accumulative" means that a pesticide

Breaks down quickly in the environment . . 1 35/

Breaks down slowly in the environment. . . 2

Builds up in the bodies of animals 3

Is harmless to the environment 4

24. When working with pesticides, it is best to wear boots that are made of

Canvas 1 36/

Leather 2

Neoprene rubber 3

Disposable paper 4

IN THIS SECTION, CIRCLE THE ONE CODE FOR EACH ITEM THAT YOU THINK BEST ANSWERS THE QUESTION ASKED.

25. The type of pesticide applicator that is least prone to drift problems is the

Air blast sprayer 1 37/
Power duster 2
Hydraulic sprayer 3
Granular applicator 4

26. If a sprayer has a tank capacity of 40 gallons, and the application rate called for is 8 gallons per acre, one tankful can spray

10 acres 1 38/
7 acres 2
5 acres 3
4 acres 4

27. If you are using an abrasive wettable powder pesticide, your best choice of the following for a sprayer nozzle would be

Stainless steel 1 39/
Aluminum 2
Brass 3
Plastic 4

28. In order to properly calibrate a granular applicator you should operate the equipment to apply

10 pounds of granules. 1 40/
20 pounds of granules 2
Enough product to cover at least 1/4 acre . . 3
Enough product to cover at least 1/8 acre . . 4

IN THIS SECTION, CIRCLE THE ONE ANSWER CODE FOR EACH ITEM THAT YOU THINK BEST ANSWERS THE QUESTION ASKED.

29. The term "ppm" used in reference to pesticide tolerances means

Pounds of pesticide per month 1 41/
Parts of product measured 2
Parts per million 3
Pounds of pesticide maximum 4

30. Federal law requires that all applicators must be certified in order to use a pesticide classified as

Commercial use 1 42/
Restricted use 2
General use 3
Classified use 4

31. It is sometimes necessary to use a pesticide in a manner which is not directed by the container label

To stop the spread of a harmful pest 1 43/
To calibrate application equipment 2
To prevent severe financial losses due to crop damage 3
Never should be done - it is a violation of Federal law 4

32. Under Federal law a private applicator who uses a pesticide in a manner prohibited by the label is liable to

Lose his certification but receive no other penalties 1 44/
Receive criminal fines up to $1000 and/or 30 days in prison 2
Receive criminal fines up to $5000 and/or 6 months in prison 3
Receive any penalty decided upon by the court 4

IN THIS SECTION, CIRCLE THE ONE ANSWER CODE FOR EACH ITEM THAT YOU THINK BEST ANSWERS THE QUESTION ASKED.

33. A person who is not a certified applicator can use a restricted-use pesticide if he

Is under the direct supervision of the property owner 1 45/

Applies the pesticide according to the label directions 2

Is under the direct supervision of a certified applicator 3

Willingly assumes legal responsibility for any consequences 4

34. A private applicator who commits a pesticide violation for which he has not previously cited will most likely be

Issued a warning 1 46/

Given a civil penalty of $1000 or less 2

Given a criminal penalty of 30 days in prison 3

None of the above 4

35. A pesticide that is not registered

Can only be used on private property 1 47/

Can only be used with permission from the manufacturer 2

Is legal for use only in emergency situations 3

Is not legal for use in any situation 4

IN THIS SECTION, CIRCLE THE ONE ANSWER CODE FOR EACH ITEM THAT YOU THINK BEST ANSWERS THE QUESTION ASKED.

36. A certified private applicator may apply restricted-use pesticides to the property of another person

For any purpose if the owner consents 1 48/

For the production of agricultural crops . . 2

For the production of agricultural crops and without receiving money for his services 3

Provided the money received for his services is reasonable 4

37. The primary responsibility for enforcing pesticide laws under FIFRA belongs to

The States only 1 49/

EPA and USDA 2

The States and EPA 3

The States and USDA 4

SECTION II

1. About how many acres of land do you farm? (INCLUDE ALL LAND RENTED OR OWNED. CIRCLE ONE ANSWER CODE.)

Less than 25 acres	1	50/
25 - 49 acres	2	
50 - 99 acres	3	
100 - 199 acres	4	
200 acres or more	5	

2. What are your principal crops? (LIST MOST IMPORTANT FIRST)

1. ______________________________ 51-52/
2. ______________________________ 53-54/

3. What was the last year of school that you completed? (CIRCLE ONE ANSWER CODE.)

Less than 8th grade	1	55/
8th to 11th grade	2	
High school graduate	3	
Some college or technical school	4	
College graduate	5	

4. What is your age? (CIRCLE ONE ANSWER CODE.)

19 or less	1	56/
20-24	2	
25-34	3	
35-44	4	
45-54	5	
55-64	6	
65 or more	7	

5. How far do you live from the nearest city with a population of 30,000 or more? (CIRCLE ONE ANSWER CODE.)

Less than 25 miles	1	57/
Between 25 and 49 miles	2	
Between 50 and 99 miles	3	
Between 100 and 199 miles	4	
200 miles or more	5	
Don't know	8	

6. How many years of experience do you have in using pesticides?

Less than 2 years	1	58/
2-4 years	2	
5-10 years	3	
11-20 years	4	
21 years or more	5	

STOP! DO NOT OPEN THE NEXT QUESTIONNAIRE UNTIL YOU ARE INSTRUCTED TO DO SO.

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EVALUATION OF THE PRIVATE APPLICATOR PESTICIDE TRAINING AND CERTIFICATION PROGRAM: A FIVE-STATE STUDY

APPENDIX G: Five-State Study Questionnaire

Laura R. Studen,
Project Director

Jonathan D. Hodgdon,
Deputy Project Director

Prepared by Abt Associates Inc. for the Environmental Protection Agency and the Council on Environmental Quality under Contract No. EQ9AC014, as amended. Opinions expressed herein are those of the Contractor and do not necessarily represent the official views of the sponsoring and participating federal and state agencies.

AN EQUAL OPPORTUNITY EMPLOYER

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RESPONDENT LABEL

PESTICIDE APPLICATOR STUDY
PREVIOUSLY CERTIFIED PRIVATE APPLICATORS

(ASK TO SPEAK TO LISTED APPLICATOR)

Hello, I'm ________________ of Abt Associates, an independent research firm in Cambridge, Massachusetts. With the cooperation of . . . we are conducting a study to help determine the effectiveness of [the Pesticide Training and Certification Program]* in your state. The study is being done for the Environmental Protection Agency and the Council on Environmental Quality with the help of your [state's Extension Service.] While your cooperation is voluntary, your opinions about [the Pesticide Certification Program] are important to our evaluation. Your answers are completely confidential and will in no way affect your certification status. They will be used only to study participants and will help your state improve its program.

---

*[Bracketed material to be written specifically for each state.]

A. IS THIS A CONVENIENT TIME FOR YOU TO BE INTERVIEWED?

Yes (SKIP TO Q.B) 1

No (ASK Q.A1) 2

A1. IS THERE A MORE CONVENIENT TIME FOR ME TO CALL YOU BACK?

Yes . . . . 1 Day: __________ Time __________

No (ASK Q.A2) . . 2

A2. WHY DO YOU PREFER NOT TO BE INTERVIEWED?

____

____

B. Could you please just tell us the following information about your status as a private applicator:

B1. Have you ever been certified as a private pesticide applicator?

Yes. 1

No 2

B2. Did you participate in either a training program or a self-study program before you were certified?

Yes. 1

No 2

B3. Are you now an active grower or farmer?

Yes. 1

No 2

TERMINATE INTERVIEW IF RESPONDENT IS EITHER UNWILLING TO BE INTERVIEWED OR ANSWERED "NO" TO ANY PORTION OF QUESTION B.

SECTION I

1a. In the past three years, how often have you applied pesticides to control insects, weeds, or plant diseases? (CIRCLE ONE ANSWER ONLY.)

Many times a year (more than 5) 1

A few times a year (2-5 times). 2

About once a year 3

Never 4

(SKIP TO SECTION II) ◄

1b. Do you use pesticides mostly to control insects, to control weeds, or to control plant diseases? (CIRCLE ONE ANSWER CODE.)

Control insects. 1

Control weeds. 2

Control plant diseases 3

Now please tell me whether or not you feel there are differences in your use of pesticides as a result of your participation in [your state's Pesticide Applicator Training Program.] Please answer as best you can even though it may have been several years since your training. First of all . . .

2a. Are there any differences since training in the methods you use to determine what kinds of pests are causing the problem?

Yes 1
No. 2
(SKIP TO Q.3a) ←
Don't know. 8
(SKIP TO Q.3a) ←

2b. (IF YES) What differences are there? (PROBE FOR SPECIFICS)

____
____
____

3a. In situations where you did not plan to use a pesticide but later decided you should, is there any difference since training in the amount of crop damage you allow before deciding to use pesticides?

Yes 1
No. 2
(SKIP TO Q.4a) ←
Don't know. 8
(SKIP TO Q.4a) ←

3b. (IF YES) What difference is there? (PROBE FOR SPECIFICS)

Allow more 1
Other (SPECIFY). 7

____

4a. Are there differences since training in the methods you use to transport pesticides in your car or truck?

Yes 1

No. 2

(SKIP TO Q.4c) ←

Does not apply (delivered). . 7

(SKIP TO Q.5a) ←

Don't know. 8

(SKIP TO Q.5a) ←

4b. (IF YES) What differences are there? (PROBE FOR SPECIFICS.)

____

____

____

____

SKIP TO Q.5a

4c. (IF NO) When you carry this pesticide in your own car or truck, where do you usually put it? (DO NOT READ LIST, CIRCLE ONE CODE.)

Bed of truck. 1

Cab of truck. 2

Trunk of car. 3

Front or back seat of car . . 4

Other: (SPECIFY) 5

____

5a. **Is there any difference since training in the clothing or protective equipment you wear when mixing and loading pesticides that have a skull and crossbones symbol on the label?**

Yes	1
No.	2
(SKIP TO Q.5c) ←	
Does not apply.	7
(SKIP TO Q.6a) ←	
Don't know.	8
(SKIP TO Q.6a) ←	

5b. (IF YES) What types of outer clothing or protective equipment do you wear while you are mixing and loading such pesticides that you did not wear prior to training? (DO NOT READ LIST. CIRCLE ALL THAT APPLY.) (PROBE: Anything else?)

Waterproof gloves	1
Waterproof boots.	2
Long-sleeved shirt.	3
Long trousers	4
Goggles or face shield.	1
Respirator.	2
Dust mask	3
Hat	4
Coveralls	1
Other: (SPECIFY).	2
______________________________	
No protective clothing used	3

SKIP TO Q. 6a

5c. (IF NO) Please name all outer clothing and other protective equipment you wear while you are mixing and loading pesticides that have a skull and crossbones symbol on the label. (DO NOT READ LIST, CIRCLE ALL THAT APPLY.) (PROBE) Anything else?

Waterproof gloves 1

Waterproof boots. 2

Long-sleeved shirt. 3

Long trousers 4

Goggles or face shield. 1

Respirator. 2

Dust mask 3

Hat 4

Coveralls 1

Other: (SPECIFY). 2

____

No protective clothing used . . . 3

6a. Is there any difference since training in the clothing you wear when spraying pesticides that have a skull and crossbones symbol on the label?

Yes 1

No. 2

(SKIP TO Q.6c) ◄

Does not apply. 7

(SKIP TO Q.7a) ◄

Don't know. 8

(SKIP TO Q.7a) ◄

6b. (IF YES) What types of outer clothing or protective equipment do you wear while you are spraying such pesticides that you did not wear prior to training? (DO NOT READ. CIRCLE ALL THAT APPLY.) (PROBE: Anything else?)

Waterproof gloves	1
Waterproof boots	2
Long-sleeved shirt	3
Long trousers	4
Goggles or face shield	1
Respirator	2
Dust mask	3
Hat	4
Coveralls	1
Other: (SPECIFY)	2
No protective clothing used	3

SKIP TO Q. 7a

6c. (IF NO) Please name all outer clothing and other protective equipment you wear while you are mixing and loading pesticides that have a skull and crossbones symbol on the label. (DO NOT READ LIST, CIRCLE ALL THAT APPLY.) (PROBE) Anything else?

Waterproof gloves	1
Waterproof boots	2
Long-sleeved shirt	3
Long trousers	4
Goggles or face shield	1
Respirator	2
Dust mask	3
Hat	4
Coveralls	1
Other: (SPECIFY)	2
No protective clothing used	3

7a. Are there any differences since training in the methods you use or the frequency with which you calibrate your equipment?

Yes 1

No. 2
(SKIP TO Q.7c)

Don't know. 8
(SKIP TO Q.8a)

7b. (IF YES) What differences are there? (PROBE FOR SPECIFICS)

____

____

____

SKIP TO Q. 8a

7c. (IF NO) About how often do you calibrate your application equipment? (DO NOT READ LIST. CIRCLE ONE RESPONSE CODE.)

Before each application. 1

Before every two or three applications . . . 2

Before every four to six applications. . . . 3

Less often 4

8a. Are there any differences since training in the methods you use to prevent pesticide spray drift?

Yes 1

No. 2
(SKIP TO Q.8c)

Don't ever spray. 3
(SKIP TO Q.9a)

Don't know. 8
(SKIP TO Q.9a)

8b. (IF YES) What do you do that is different? (DO NOT READ LIST. CIRCLE ALL THAT APPLY.) (PROBE: Anything else?)

Spray when the wind is low 1
Spray according to wind direction. 2
Spray during cooler times of the day . . . 3
Use lower pressure 4
Use larger nozzle opening. 1
Use a drift control agent. 2
Other: (SPECIFY). 3

____

____

SKIP TO Q. 9a

8c. (IF NO) What do you do to control spray drift? (DO NOT READ LIST, CIRCLE ALL THAT APPLY.)

Spray when the wind is low 1
Spray according to wind direction. 2
Spray during cooler times of the day . . . 3
Use lower pressure 4
Use larger nozzle opening. 1
Use a drift control agent. 2
Other: (SPECIFY). 3

____

____

No precaution taken. 4

9a. Is there any difference since training in what you do if you spill a small amount of the undiluted pesticide on your clothing or skin?

Yes 1

No. 2

(SKIP TO Q.10a)

Don't know. 8

(SKIP TO Q.10a)

9b. (IF YES) What do you do that is different? (PROBE FOR SPECIFICS)

____

____

10a. Is there any difference since training in what you do with the leftover pesticide when the job is finished?

Yes 1

No. 2

(SKIP TO Q.10c)

Don't know. 8

(SKIP TO Q.11a)

10b. (IF YES) What do you do that is different? (DO NOT READ LIST. CIRCLE ALL THAT APPLY.) (PROBE: Anything else?)

Drain it into the ground 1

Leave it in the applicator 2

Apply it to another field. 3

Continue applying it to the same field until applicator is empty. 4

Dilute the pesticide, then spray the same field until applicator is empty . . 1

Other: (SPECIFY). 2

____

____

SKIP TO Q. 11a

10c. (IF NO) What do you do with the leftover pesticide when the job is finished? (DO NOT READ LIST, CIRCLE ALL THAT APPLY.)

Drain it into the ground 1

Leave it in the applicator 2

Apply it to another field. 3

Continue applying it to the same
field until applicator is empty. 4

Dilute the pesticide, then spray the
same field until applicator is empty . . 1

Other: (SPECIFY). 2

11a. Is there any difference since training in the way you dispose of empty pesticide containers?

Yes 1

No. 2
(SKIP TO Q. 11c)

Don't know. 3
(SKIP TO Q. 12a)

11b. (IF YES) What do you do that is different? (DO NOT READ LIST. (CIRCLE ALL THAT APPLY.) (PROBE: Anything else?)

Re-use them. 1

Burn them. 2

Bury them. 3

Leave them unburied in a private
trash dump 4

Haul them to a community landfill. . . . 1

Store in a protected place awaiting
disposal 2

Other: (SPECIFY). 3

SKIP TO Q. 12a

11c. (IF NO) What do you do with the empty pesticide containers? (DO NOT READ LIST. CIRCLE ALL THAT APPLY.)

Re-use them. 1

Burn them. 2

Bury them. 3

Leave them unburied in a private trash dump 4

Haul them to a community landfill. . . . 1

Store in a protected place awaiting disposal 2

Other: (SPECIFY). 3

____

12a. Is there any difference since training in the way in which you store your pesticide and equipment?

Yes 1

No. 2

(SKIP TO Q. 12c) ◄┘

Don't know. 8

(SKIP TO SECTION II) ◄┘

12b. (IF YES) What do you do that is different? (DO NOT READ LIST. CIRCLE ALL THAT APPLY.) (PROBE: Anything else?)

Keep them locked 1

Keep them out of reach of children 2

Keep them away from high traffic areas . . 3

Other: (SPECIFY). 4

____

____

SKIP TO SECTION II

12c. (IF NO) How do you store your pesticides and equipment when they are not in use? (PROBE FOR SPECIFICS.)

____

____

SECTION II

1. How important do you feel it is for the state to have a restricted pesticide certification program for private applicators? Would you say certification is very important, somewhat important, or not very important? (CIRCLE ONE ANSWER CODE.)

Very Important	1
Somewhat important	2
Not very important	3

2. Overall how worthwhile did you find the state private applicator training program to be? Would you say the training was very worthwhile, somewhat worthwhile, or not very worthwhile? (CIRCLE ONE ANSWER CODE.)

Very worthwhile.	1
Somewhat worthwhile.	2
Not very worthwhile.	3

3. What do you think the advantages are of having a state private applicator training and certification program? (DO NOT READ LIST. CIRCLE ALL THAT APPLY.) (PROBE: Anything else?)

Makes you aware of the dangers of using chemicals. . .	1
Teaches you how to use chemicals properly.	2
Helps to protect crops and livestock	3
Helps to protect the environment including fish, wildlife, and vegetation	4
Prevents the misuse of chemicals by farmers.	1
Provides an opportunity to discuss pest control problems with the county agent and other farmers . . .	2
Other: (SPECIFY).	3

____

____

4. What do you think the disadvantages are of having a state private applicator training and certification program? (DO NOT READ. CIRCLE ALL THAT APPLY.) (PROBE: Anything else?)

Is an inconvenience to farmers	1
Involves too much government interference	2
Did not learn anything new	3
Was not what I needed to do my job	4
Did not go far enough.	1
Is not important to farmers.	2
Other (SPECIFY).	3

____

____

5. If you are not sure about how to use a pesticide or which pesticide to use, where would you be most likely to go for help? (DO NOT READ, CIRCLE ONLY ONE ANSWER CODE.)

Neighbor or relative	1
Chemical dealer	2
County extension agent	3
State Department of Agriculture official	4
Vocational agriculture teacher	5
Farm magazines and publications	6
Other: (SPECIFY)	7

6. Thinking of the number of pesticides currently restricted in your state, would you say that too many are restricted, too few, or about the right number?

Too many	1
Too few	2
About the right number	3
Don't know	8

SECTION III

1. About how many acres of land do you farm? Please include all land rented or owned? (READ LIST. CIRCLE ONE ANSWER CODE.)

Less than 25 acres	1
25 - 100 acres	2
101 - 500 acres	3
501 -2000 acres	4
2000 acres or more	5

2. What are your principal crops? (LIST MOST IMPORTANT FIRST.)

1. ____________________

2. ____________________

3. What was the last year of school that you completed? (READ LIST. CIRCLE ONE ANSWER CODE.)

Less than 8th grade	1
8th to 11th grade	2
High school graduate	3
Some college or technical school	4
College graduate	5

4. What is your age? (READ LIST. CIRCLE ONE ANSWER CODE.)

19 or less	1
20 - 24	2
25 - 34	3
35 - 44	4
45 - 54	5
55 - 64	6
65 or more	7

5. About how many years of experience do you have in using pesticides? (READ LIST. CIRCLE ONE ANSWER CODE.)

Less than 2 years	1
2 - 4 years	2
5 -10 years	3
11-20 years	4
21 years or more	5

6. Approximately how much did you spend on insecticides, fungicides, herbicides, and other pesticides last year? Would you say less than $1000, between $1000-$5000, or more than $5000? (CIRCLE ONE ANSWER CODE.)

Less than $1000. 1

Between $1000 - $5000. 2

More than $5000. 3

7a. Did you participate in a classroom-type state training session or did you become trained through an individual self-study course? (CIRCLE ONE ANSWER CODE.)

Training session 1

(ASK Q. 7b) ◄

Self-study 2

(ASK Q. 7d) ◄

7b. (IF TRAINING SESSION) Did your training session include a . . . (READ ITEMS, CIRCLE ONE ANSWER CODE FOR EACH ITEM.)

	Q.7b		Q.7c		
	Yes	No	Very Useful	Somewhat Useful	Not Very Useful
Slide/tape program	1	2	1	2	3
Film or videotape.	3	4	1	2	3
Demonstration program. . . .	1	2	1	2	3
Lecture	3	4	1	2	3
Training manual.	1	2	1	2	3
Workbook	3	4	1	2	3

7c. (FOR EACH "YES" RESPONSE IN Q.7b ASK) Would you say the (READ ITEM) was very useful, somewhat useful, or not very useful? (RECORD ANSWER CODES ABOVE.)

SKIP TO Q.8

7d. (IF SELF-STUDY) Did your self-study course include a . . . (READ ITEMS, CIRCLE ONE ANSWER CODE FOR EACH ITEM.)

	Q.7d		Q.7e		
	Yes	No	Very Useful	Somewhat Useful	Not Very Useful
Slide/tape program	1	2	1	2	3
Film or videotape.	1	2	1	2	3
Training manual.	1	2	1	2	3
Workbook	1	2	1	2	3

7e. (FOR EACH "YES" RESPONSE IN Q.7d, ASK) Would you say the (READ ITEM) was very useful, somewhat useful, or not very useful? RECORD ANSWERS ABOVE.)

8. In what year did you first receive your state Private Applicator Certification? (CIRCLE ONE ANSWER)

Year 75 76 77 78 79 80

9. In what year does or did your initial state certification expire? (CIRCLE ONE ANSWER CODE.)

Year 79 80 81 82 83 84 85

10a. Do you plan to become recertified in your state?

Yes 1

No 2
(ASK Q.10c)

Already recertified 3
(ASK Q.10b)

Don't know 8

10b. (IF ALREADY RECERTIFIED) How worthwhile did you find the state Private Applicator Recertification Program to be? Would you say very worthwhile, somewhat worthwhile, or not very worthwhile? (CIRCLE ONE ANSWER CODE.)

Very worthwhile 1

Somewhat worthwhile 2

Not very worthwhile 3

SKIP TO END

10c. (IF NO) Why don't you plan to become recertified. (DO NOT READ LIST. CIRCLE ALL THAT APPLY.) (PROBE: Anything else?)

Not legally required in my state 1

More trouble than it would be worth. 2

Will no longer be using restricted pesticides 3

Will be moving out of the state. 4

Don't feel I would learn anything new. 1

Haven't needed my certification card to purchase restricted pesticides 2

Other: (SPECIFY). 3

____

THIS COMPLETES THE INTERVIEW. THANK YOU VERY MUCH FOR YOUR TIME AND COOPERATION.

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EVALUATION OF THE PRIVATE APPLICATOR PESTICIDE TRAINING AND CERTIFICATION PROGRAM: A FIVE-STATE STUDY

APPENDIX H: Interviewer Training Manual

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ABOUT THE STUDY

Purpose and Sponsorship

Since 1975, federal pesticide regulations have required state agricultural agencies to establish and maintain certification standards for all users of "restricted use" pesticides. Restricted use pesticides are those which the U.S. Environmental Protection Agency has deemed sufficiently hazardous to require a special permit for their purchase and application (depending upon their purpose, pesticides may also be referred to by other classifications such as insecticides, herbicides, fungicides, or rodenticides). Individual states may also add other pesticides to the restricted list.

Private applicator permits are issued in each state to individuals who wish to apply restricted pesticides to their own fields or crops. Commercial applicator permits are issued to those who are in the business of applying restricted pesticides to others' fields or crops for profit. Separate training and certification programs for private and commercial applicators have been initiated in each of the states, some as early as five years ago, others more recently. In most states, the training is sponsored by the Cooperative Extension Service and conducted by local county extension agents and the certification, or license is given by the state lead agency.

The purpose of this study is to evaluate the private applicator training and certification program in five states: Georgia, Iowa, New York, Nebraska, and Pennsylvania. The study is being done for the Environmental Protection Agency and the Council on Environmental Quality, with the cooperation of administrative agencies in each of the five states.

The government sponsors of this survey want to know if applicators believe their pesticide use and handling practices have improved as a result of participating in the training and certification process. The sponsors need to know if the training and certification has accomplished its objectives of increasing applicators' awareness of the dangers of using pesticide products and the safety precautions that can be taken to protect them and the environment. The sponsors need to know in what areas changes have occurred as a result of the training and certification process.

The results of this survey will be used to support future decisions in planning and programming related to applicator training and certification.

The Role of the Interviewer

Your role as an interviewer is vital to the success of this survey. You, the interviewers, will be the only ones speaking directly with the certified private applicators who participate in this survey. It is essential that you establish good rapport with the respondents and collect accurate, complete, and clear information from them.

This Interviewers' Manual provides information you need to perform your job successfully. It is intended as a reference handbook for use throughout the field period, as well as the training manual that guides us through this training session. After the training session, continue to familiarize yourself with the contents of the Interviewers' Manual. Discuss with your supervisor any points you do not fully understand. Always feel free to ask your supervisor questions about any aspect of your duties.

SAMPLING INFORMATION

Case Assignments

Your supervisor will assign to you the specific interview cases that you will work on. Still, we want you to have an overview of the project as a whole, so that you can better understand your part in it.

Interviewing will be conducted in five states. These states are: Georgia, Iowa, Nebraska, New York, and Pennsylvania. We need to complete a minimum of 400 interviews in each of these states, for a total of 2,000 interviews.

But our responsibility goes beyond simply achieving a "total" number of required interviews. We must be certain that all certified private applicators who were randomly selected as potential respondents in the study have an equal chance of participating in the survey. To accomplish this, we have established procedures that must be strictly followed.

The following paragraphs explain the procedures we will use in this study.

A preliminary sample of potential respondents will be provided to your supervisor. She/he will distribute the workload among the interviewers. The Survey Director will have back up sample available to release to the supervisor as it is needed by the interviewers.

By releasing the sample as it is needed, we can closely monitor our approach to the required minimum of 400 completed interviews per state. At the same time we can meet our obligation of "equal chance for representation" among potential respondents without concern of going far beyond the required number of completions.

"Equal chance" means that, once a case is assigned to an interviewer, the potential respondent is assured of having the same chance of being reached and interviewed as any other sampled respondent whose case is assigned to an interviewer.

Making Your Calls

Dial the phone number that appears on the Respondent Label on the cover of the questionnaire. Record the date (e.g., 3/18) and the time (e.g., 7:35 p.m.) on the grid entitled "Record of Case Calls." (Note that if your dial is the first attempt to reach this respondent, record details on the line labeled "Initial Call." If your dial is the second attempt, record on line labeled "First Callback." If your dial is the third attempt, record on line labeled "Second Callback.")

At this point, one of several things can happen. The possibilities--and codes assigned to them--are shown below:

Code	Possible Result of Call	
01	Interview Completed	FINAL STATUS CODES
02	Refusal/Break off	
03	Ineligible	
04	Nonworking/Wrong Number	
05	Respondent Unavailable	
06	Final No Contact	
07	Other (specify)	
21	Callback (scheduled)	PENDING STATUS CODES
22	Callback (unscheduled)	
23	Line busy/No Answer	

For easy reference, these codes are shown on the cover sheet of each questionnaire. Notice that the first seven codes are designated "Final Status Codes" (i.e., no callback will be necessary). The last three codes are designated "Pending Status Codes." Selecting the accurate code will allow you to determine who should be called back for an interview. Callbacks must always be made when status is pending.

Definitions of the final status codes follow:

01 Completed Interview. An interview is complete when an eligible respondent answers all appropriate questions in the questionnaire.

02 Refusal/Break off. When a respondent does not wish to be interviewed at the time you call, will not indicate another time to call, and clearly does not want to be interviewed, consider this a refusal. (Note that a pre-test of this questionnaire revealed a high level of cooperation among the survey population.) "Break off" refers to a termination while the interview is in progress. (Whenever possible, make arrangements to continue the interview later at a time convenient to the respondent so that a break off is converted to a completed interview.)

03 Ineligible. Interviews will be terminated if a respondent does not meet all of these eligibility requirements:

- Respondent has been certified as a private pesticide applicator.
- Respondent participated in a training program or self-study program before certification.
- Respondent is currently an active grower or farmer.

(Additional information about questions that establish eligibility is discussed on page 12.)

04 Nonworking/Wrong Number. Use this code if the telephone number shown on the cover sheet is disconnected or not working for any reasons. Also use it if it turns out to be the wrong number for the appropriate respondent you need to reach.

Do not call Directory Assistance and attempt to obtain the correct telephone number unless you have been specifically instructed to do so by your supervisor.

05 Respondent Unavailable. Remember that this is a final status code and is used only if no callbacks are required. Use it when someone answers the phone but tells you the respondent will be unavailable for the duration of the field period (i.e., through April 24, 1981). Be sure to write the specific information you are given on the cover sheet. Your supervisor and the Survey Director will need to know exactly what occurred.

If the initial callback and first callback have been made, and you are making callback #2, use this code to indicate you spoke with someone in the household, but the correct respondent was unavailable.

06 Final No Contact. Remember that this is a final status code and is used only if no callbacks are required. It is applicable if you are making the second callback, and you are unable to reach anyone at the number.

07 Other. Use this code when none of the other Final Status Codes (01 through 06) are applicable. Be certain to specify what the "other" result is. "Respondent Deceased" or "Language Barrier" are examples of an appropriate Code 07.

When recording Final Status Codes (01 through 07) always enter them in the column labeled FINAL STATUS.

In some cases, callbacks are required. Pending status codes should be entered in the PENDING STATUS column in these cases.

Definitions of the pending status codes follow:

21 Callback (scheduled). If you reach someone at the telephone number, but the designated respondent is not home or busy, try to make a firm appointment to call back. If you are able to make a firm appointment, use Code 21 and write in the day, date and time of the appointment in the column labeled SCHEDULED CALLBACK/SUGGESTED CALLBACK. If the appointment time is during the same shift, be sure that you keep any appointments you make. At the end of your shift, advise your supervisor of any other appointments you made, so she/he can be certain respondents are called at specified times.

22 Callback (unscheduled). If you reach someone at the telephone number, but the designated respondent is not home or busy, try to make a firm appointment to call back. If you are unable to make a firm appointment, ask the answerer to suggest a good time to call back. Use Code 22 and write in the best information the answerer can provide in the column labeled SCHEDULED CALLBACK/SUGGESTED CALLBACK. If answerer cannot provide a suggested callback time, a callback will be made on another day, at another time to allow the greatest chance of reaching the respondent.

Special Note: When making appointments for callbacks or getting suggested callback times, keep in mind that interviewing for this project is scheduled for the following times:

Monday - Thursday, 3 p.m. to 9 p.m.
Saturday, 9 a.m. to 5 p.m.
Sunday, 1 p.m. to 9 p.m.

Try not to make firm appointments for times other than these. When discussing suggested callback times with answerers, let them know when calling is being done. If a respondent can only be reached at a time other than scheduled interviewing shifts, tell your supervisor. Special arrangements will be made by your supervisor to interview the respondent. Do not make such arrangements yourself unless absolutely necessary. In the event that you must (to avoid losing a respondent), alert your supervisor.

23 Line Busy/No Answer. If a line is busy or there is no answer, do not make any callbacks during the same shift. Callbacks will be made on different days and at different times to allow the highest chance of reaching the respondent. (Note: If the phone rings, let it ring six times before assuming "no answer" and hanging up.)

This is an initial call, plus two callbacks, survey. Attempts coded 21, 22, and 23 are eligible for callbacks. In order to guarantee an "equal chance" of participating to respondents who are assigned to interviewers, three call attempts must be made, where appropriate (i.e., respondent has not been reached).

Always record the LENGTH OF CALL of completed interviews. Record minutes accurately; we will be using this information to analyze calling experience. Always write your initials in the column labeled INTERVIEWER INITIALS, so we'll know who made which call.

ADMINISTERING THE QUESTIONNAIRE

The Cover Sheet

The cover sheet of the questionnaire has been color-coded for each state. These color codes are:

Georgia - Pink
Iowa - Green
Nebraska - Blue
New York - Tan
Pennsylvania - Tangerine

(This is the only page of the questionnaire that differs by state.)

A label has been adhered to each cover sheet. The following information is provided on the label:

- Respondent Identification Number. Each respondent I.D. is five characters in length. The first character is an alphabetic code that identifies the state by which the respondent was licensed. (Note: Respondent need not be living in that state.) These codes are: G for Georgia, I for Iowa, N for Nebraska, Y for New York, and P for Pennsylvania. The remaining four characters are numeric and identify a particular respondent within each state group.
- Name, address, and telephone number of the respondent.

The cover sheet also serves as a "call record" for each respondent's case. The status codes and the grid entitled "Record of Case Calls" are provided on the cover sheet. (Both are defined in the previous section of the manual.)

Always ask to speak to the applicator listed on the label. This person is the designated respondent. No one else in the household may answer on behalf of this respondent.

An introductory paragraph, which refers specifically to the state agency which sponsored the training in that state, is provided at the bottom of each cover sheet. This will allow you to refer to an organization and training program title that are familiar to the respondent. (You may also inform the respondent that the interview will take 15 to 20 minutes if you are asked.)

Below are some special notes that apply to particular states:

Georgia: The growers' memories may have to be jogged, since for many of them certification was the only interaction they ever had with a county agent. It might help to refer to the program as "the training you received from your local county agent to get certified so that you could purchase and use restricted pesticides."

Iowa: There's a potentially confusing element involved in Iowa's survey. A year or so ago, a university student conducted a survey similar to ours (scope of the survey is unknown), so it is possible that a respondent may have been interviewed previously. Interviewers should be prepared to explain that our survey is a totally separate survey. (Of course, no mention should be made of the other survey unless the grower mentions it.)

Nebraska: Unlike the situation in the other participating states, Nebraska is currently undergoing massive re-certification. Thus, the interviewer can expect a healthy percentage of respondents to have received re-certification training (possibly as many as 50%). Therefore, it must be explicitly clear that our interview refers mainly to the original certification/training.

Pennsylvania: The interviewer should be prepared to jog the respondent's memory. The program may be referred to as "training for pesticide license or permit" or "private applicator training." Unlike the other states, Pennsylvania's private applicator training program consists primarily of a self-study correspondence course.

The states are responsible for sending "introductory" letters to potential survey respondents and for notifying county agents about the study. AAI has provided mailing labels to all states to assist them in sending these letters. Unfortunately, not all of the states have elected to send these letters, so some respondents will not have received an "advance" letter before they receive a call from you.

Samples of letters sent by states are appended to this Manual. Please refer to them so you know what respondents have been told.

Special Circumstance: If, at any time, a respondent refuses to be interviewed because he does not believe AAI is authorized to conduct the survey, alert your supervisor. She/he will have a list of each state's training program leader; she/he will discuss with you the likelihood of converting the refusal to a completion by providing this name to the respondent or by inviting the respondent to contact his/her county agent.

Questionnaire Conventions

Instructions to interviewers are provided in upper case type. Such instructions include directions for when you READ LIST of categories and when you DO NOT READ LIST. Instructions are also provided for when you CIRCLE ONE ANSWER ONLY versus when you CIRCLE ALL THAT APPLY.

Be sure to follow these instructions exactly. It is essential that we maintain consistent questionnaire administration among the 15 interiewers assigned to this survey.

There are also instructions that tell you when and where to skip, if a respondent's answer to a question makes it illogical for him to be asked certain subsequent questions.

For example: If you ask, "Are there any differences since training in the methods you use to determine what kinds of pests are causing the problem?", only those who answer, "Yes" would be asked "What differences are there?" If a respondent answers "No" or "Don't know," you will be instructed to skip the question that applies only to respondents who answer "Yes".

There are two types of questions found in the questionnaire.

One type is called a "pre-listed" or close-ended question. This type of question is followed by a list of possible responses. The interviewer circles the appropriate response(s). An example of a close-ended question is:

4c. (IF NO) When you carry this pesticide in your own car or truck, where do you usually put it? (DO NOT READ LIST, CIRCLE ONE CODE.)

Bed of truck.	1	23/
Cab of truck.	2	
Trunk of car.	3	
Front or back seat of car . .	4	
Other: (SPECIFY)	5	

____

In some instances, pre-listed questions will include an "other, specify" category, as our example does. Be sure to write "other" answers down verbatim.

If you are ever in doubt about which category to circle, write down exactly what the respondent said. Please do not make decisions about how to code information that is ambiguous or vague. Never try to put an answer in a category where it doesn't seem to fit. When in doubt, write it out.

The other type of question is considered open-ended. This is a question the respondent answers entirely in his own words and for which no answer categories are provided on the questionnaire.

An example of an open-ended question follows:

4b. (IF YES) What differences are there? (PROBE FOR SPECIFICS.)

19-20/

21-22/

The more precisely you record what a respondent says on such a question, the more valuable your interview is to us. Be sure to probe for specifics and for additional information.

Screening Section (Question A, A1, A2 and B1, B2, B3)

Question A will allow you to find out if the respondent is free to be interviewed when you call. If not, use Question A1 to establish a convenient calling time. If respondent resists being interviewed, find out why by asking Q. A2. If a respondent is hesitant about cooperation, find out what the objections are. Offer to answer questions. If you can clearly explain why we want to ask those questions, we believe respondents are likely to participate.

Some people may tell you they have no time or are too busy to be interviewed. Explain to them that if we only talked to people who had plenty of time, we could not get a representative picture of what's going on. Ask if you can call back at another time. Even busy people have some free time.

Ask Questions B1, B2 and B3 of everyone. These questions establish eligibility. Even if a respondent refuses to be interviewed, make an effort to obtain answers to these questions. (Note: If you discover that a respondent has refused to participate because he is ineligible, code final status as ineligible rather than refusal.)

If a respondent is unsure whether he should be considered an "active grower or farmer" or not (Question B3), probe for specifics of activities involved. "Backyard" farmers who are raising plants just for their own enjoyment or consumption are ineligible for this survey. One way to test for this situation is to find out whether the respondent sells any of the products raised. If not, he would be considered ineligible.

If you are in doubt regarding a respondent's eligibility, probe for specifics regarding growing activities. Tell respondent you must check with your supervisor regarding his eligibility and you will call back if appropriate. Then alert your supervisor and have her assist you in making this decision.

Section I (Questions 1a through 12c)

The questions in Section I focus on certified private applicator behavior relevant to pesticide product use. The Section explores differences since training of their behavior.

Note: The introductory sentence to Q.2a includes the phrase, "your state's pesticide Applicator Training Program". This phrase is shown in parentheses. This refers to the particular program mentioned in the state-specific introductory paragraph on the cover sheet of the questionnaire.

Section II (Questions 1 through 5)

These questions obtain information about respondents' attitudes and opinions about the training program.

Section III (Question 1 through 10c)

These questions are asked for statistical reasons. They will allow analysts to compare one respondent group with another by a number of variables (e.g., acres farmed, principal crops, age and education of respondent).

In this training session, we will review each question in the questionnaire. Be sure to inquire about anything that is not clear to you while we are here to assist you.

Thank you.

COOPERATIVE
EXTENSION
SERVICE
university of georgia college of agriculture • athens, ga. 30602
THE UNIVERSITY OF GEORGIA, THE U.S. DEPARTMENT OF AGRICULTURE AND COUNTIES OF THE STATE COOPERATING

March 6, 1981

Dear Sir:

This is to inform you that your name was selected at random from the private certified pesticide applicators in Georgia for a possible telephone survey.

EPA and the Georgia Department of Agriculture require that those using restricted use pesticides must be certified. You received your license based on attending a training session put on by your local county extension agent.

EPA wants to know how effective the training program was in influencing you in how you handle pesticides. Abt Associates (a private company that does surveys) has a contract with EPA to do this telephone survey in five states. About 800 names were selected in Georgia, including yours, and about 400 of these will be called. The survey has nothing to do with your keeping your license, and no answers you give will be held against you.

Since the Cooperative Extension Service is also interested in evaluating the training, we are cooperating with Abt Associates and the Georgia Department of Agriculture on this survey. If you are called we hope that you also will be cooperative in answering the questions as honestly as you can. The survey will take about 20 minutes, and will begin about March 16, 1981.

Yours truly,

Burton R. Evans
Extension Entomologist

cc: County Extension Directors
Agricultural Agents
District Agents
Dr. Jackson
Ron Conley

BRE/vp

The Cooperative Extension Service offers educational programs, assistance and materials to all people without regard to race, color or national origin.
AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION ORGANIZATION

COOPERATIVE EXTENSION NEW YORK STATE
Cornell University • State University of New York • U.S. Department of Agriculture
Chemicals-Pesticides Program (607) 256-3283
Caldwell Hall, Ithaca, N. Y., 14853

Tentative Letter for Previously Trained Applicators

Dear Sir:

ABT Associates, Cambridge, Massachusetts, have a contract with EPA to evaluate the pesticide applicator certification training program. New York State is one of six states they have selected as part of the evaluation. They have selected you at random as one of the applicators to be interviewed by telephone. They will probably call you between 7:00 and 10:00 p.m. in the near future to arrange for a telephone interview which may take 20 minutes of your time.

We hope you will cooperate in this interview. We feel that our program in New York State is one of the better ones in the country. Since training was the responsibility of the College of Agriculture and Life Sciences and Cooperative Extension, we feel that this survey is a measure of our effectiveness as educators as well as the strengths and weaknesses of our training program. We need your cooperation to have a good evaluation.

Very truly yours,

James E. Dewey
Extension Program Leader
Chemicals - Pesticides

County Agent

JED/gmw

New York State College of Agriculture and Life Sciences, New York State College of Human Ecology, and New York State Veterinary College at Cornell University, Cooperative Extension Associations, County Governing Bodies and United States Department of Agriculture cooperating